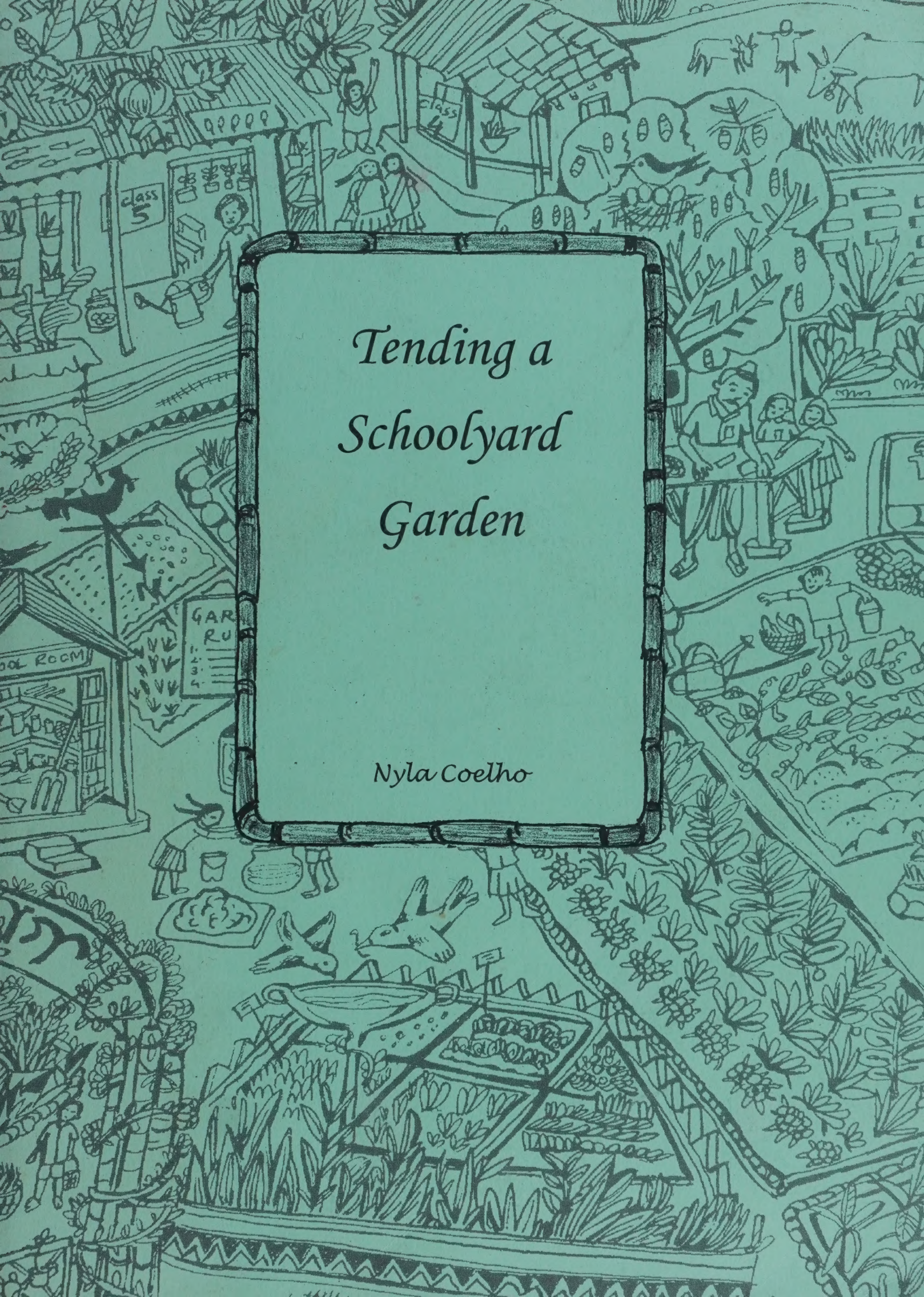

Tending a Schoolyard Garden

Nyla Coelho

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Best practices from field tests of the rural curriculum – Our Land Our Life

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August 2014

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(Best practices from field tests of the rural curriculum – Our Land Our Life)

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Foreword

Our Land Our Life, a book of curricular ideas for knowledge and skill based education was prepared at the behest of the organic farming community of this country in early 2012. Subsequently, there was a suggestion to field test the practicality of implementing such a curriculum in schools.

Anand Niketan, a government recognised experimental school located at Sewagram, Wardha, Maharashtra was selected for field testing components within the curriculum for classes one to seven. Some components applicable to senior classes were tested in two schools nearby.

Field tests began in November 2012 with the humongous task of first translating relevant parts of the text followed by transacting the idea to teachers through numerous sessions. Teachers at Anand Niketan made time, sacrificed their holidays and went out of their way to understand the demands made by such a field test. The teachers could grasp most of the content without much difficulty as the school was attuned to productive skill based learning. Smt. Sushama Sharma, the visionary head teacher of the school was always available to provide ready guidance to teachers. Dr. Priti Joshi, with decades of experience in working with the land and its attendant challenges provided technical guidance, followed up regularly with teacher meetings, trainings and demonstration of techniques. She insisted that teachers maintain regular records of all work – theirs and their pupils. Meticulous photo documentation, and, wherever possible, video documentation was undertaken. Senior teachers Jayamala Gavande, Pandit Chanole, Jayashree Kamade and Gayatri Gavande lead the team as well as assisted junior teachers Bhagyashree Ugle, Varsha Kharade, Sandhya Landge, Dimpal Sawarkar and others all through the field test period. Many subject experts generously offered their expertise through the entire process. The field tests concluded in March 2014.

Best practices from the field tests are presented in this handbook. Of the many areas within the field tests, gardening is chosen as the central theme to which cooking, food and nutrition, and, composting of garden and kitchen waste are linked. There is also a passing reference to the issue of energy.

This handbook hopes to introduce teachers and schools to the exciting world of gardening, and, through it, to the joy of working alongside children. Growing food, cooking it, taking responsibility for the waste created in the process, and, in doing so, teaching and learning vital lessons for life.

Given the vast pedagogic scope that gardening offers, this handbook is rather introductory in nature. For gaining maximum benefit from it, teachers are encouraged to refer to the detailed list of carefully selected resources in the last chapter of this book alongside the rural curriculum *Our Land Our Life*. Soft copies of all the hundred and thirty resources are provided on a CD as an

integral part of this book. An illustrated summary of the book is also enclosed.

During our many stays for prolonged periods, the Sewagram Ashram very kindly accommodated our skewed sense of community ashram life and gladly provided us with wholesome organic meals. The Nai Talim Samitee generously provided us with accommodation. Our *namaste* to each of them. The ready and abiding assistance of Deborah Dutta in reporting is gratefully acknowledged. Atreyee Day made the time to prepare an illustrated summary of the book, Gerard J. D'Silva and Collin A. D'Souza offered editorial suggestions. Their gracious contributions are much appreciated. A big thank you is offered to Cerana Foundation of Hyderabad for the institutional support during this assignment.

I thank my colleagues Smt. Sushama Sharma and Dr. Priti Joshi for their continued support and for sharing their insights on integrated pedagogy. I wish to place on record the hard work put in by the team of teachers at Anand Niketan. Their commitment and dedication to the cause of education is most commendable. May their tribe increase!

This work is in humble dedication to two ecological visionaries Claude Alvares and M.G. Jackson whose life and work is a guiding light to many. It is offered as a tribute to the Nai Talim parivar and to the growing community of gardening instructors and green teachers in schools around this country.

And to you dear teacher, who has shown trust and foresight by picking up this handbook, I offer my immense gratitude.

Nyla Coelho
August 2014

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1. Tagore's Dream and Gandhi's Vision

A century after Tagore's dream of an open to the sky classroom and seventy five years after Gandhi's vision of a work-based pedagogy, ecological compulsions are forcing serious educators to look outdoors for imparting to children life's essential lessons. Many schools and educators around the country are aware of the environmental deficit that human societies have created and continue to add to. Several measures are being taken to reverse this trend. Working with school children, inculcating in them green sensibilities is underway from the level of policy to self initiated practice.

Initiating gardening activity in the school seems for many an ideal starting point for an integrated productive work-based pedagogic approach to learning. Taking cognisance of this, the NCF (National Curricular Framework) 2005 has a dedicated position paper (3.7) on *Work and Education* which attempts to address this issue in many direct and indirect ways. So do the position papers on science and geography to some extent.

A comprehensive book *Our Land Our Life* offering curricular ideas contains valuable pointers. There is a steady revival of Nai Talim (productive work based pedagogy) schools across many states. Universities offering post graduate courses in education are setting up independent departments dedicated to such a pedagogical approach. The state of Uttarakhand has a dedicated academic course at the school level. In short, the idea is gaining acceptance.

About this document

This handbook attempts to offer teachers a ready reference for starting and keeping a schoolyard garden which can be the basis for further branching out into various academic and skill based topics as per the need and interest of individual schools. Of the numerous linkages the two most important that children can further engage in are cooking and composting.

This document is an outcome of field testing the rural curriculum – *Our Land Our Life* – at Anand Niketan, Sewagram. This is a government recognised co-education school offering education in the Marathi medium with a total school strength of nearly 200 children, mostly from lower middle class backgrounds. The school engages in many productive work based activities as it draws its philosophy from Gandhiji's Nai Talim. An added advantage is the team of highly committed teachers and adequate space for gardening. The best practices from the field tests are presented here in a ready to use and easy to follow format for the benefit of teachers and anyone desiring to engage with children through gardening.

The handbook offers detailed notes on how gardening, cooking and composting can be easily integrated into a school day. On no count can one view this as a companion volume to *Our Land Our Life*. What it does offer are insights and ideas on how skill and work based activities can be imaginatively infused to offer children an exciting learning experience – one that that will hold them

in good stead in times to come. It is an attempt at showing how one can educate today so that as responsible citizens of tomorrow, children may live through their youth and adult life as resilient, self sufficient and self reliant members of a non-violent, peaceful, cooperative community.

The activities undertaken in various classes, although not designed as such, can be broadly seen as drawing links with various aspects of everyday living and learning. One may also like to call them best practices that have been grouped such that they can help a teacher create similar learning opportunities.

Drawing linkages

Beginning with creating and keeping a schoolyard garden a teacher can link it to the ecology and environment of the school campus, weather, water and energy issues; cooking in the school kitchen, food and nutrition, health and hygiene; economics of gardening, sale or processing of surplus; management of green and non green waste, recycling; maintenance of the classroom, the school premises and the waste generated; gender and cultural issues; history and traditional knowledge systems etc. In conducting gardening activities in the school, the linkages to mindful, cooperative and democratic living can be drawn. If a school is able to do this, much can be achieved over time with continued activities in these broad areas. In three to five years the efforts will show tangible results on ground as well as in the pupils knowledge, skill, aptitude and attitudes. If sustained thus far, the school would be a reflection of an ideal learning space that we all yearn for but shy away from creating.

The advanced aspects can be dealt with as one moves from lower to higher classes, with increased level of detail and complexity. Broadly, a teacher can work around themes of ecological understanding in ways most suited for the school. Teachers and students along with some assistance from parents, local experts, books from the library and resources on the internet can explore several themes.

Understanding the locality as an ecosystem can be explored by studying the soil and land, water systems, weather, topography, farming practices, flora, fauna, forests and natural endowments.

Understanding the link between the ecosystem and one's life can be explored through local foods and dietary habits, clothing, shelter, recreation, health and wellbeing practices, traditional home remedies.

Understanding the link between the ecosystem and energy needs, appropriate waste management practices, occupation/livelihood, manmade ecosystems, and potential natural calamities are more areas for further exploration.

Progressing in complexity, advanced knowledge and skill, tasks under the above heads can be dealt with for broad age ranges of:

Age	Grade/Class
6-9	1, 2, 3
9-12	4, 5, 6
12-14	7, 8
14-16	9, 10

Below is an indicative template for the use of teachers that may come in handy for preparatory planning.

1. Title of the study topic/unit
2. Student age group
3. Ideal group size
4. Aim
5. Objective (for the teacher)
6. Background note on the purpose of the activity and the expected outcome for the student
7. Requirements:
    - Physical/infrastructure
    - Tools and equipment
    - Knowledge and expertise
    - Books and resources
    - Materials
8. Observation sheet:
    - Data/narrative notes
    - Stacking and storage for display or further observation
    - Labels
    - Location, time and date
9. Notes for briefing students on the procedure
10. Notes regarding teacher preparation
11. Notes on group management/rotation of activity
12. Notes for debriefing after the activity
13. Records:
    - Data analysis
    - Interpretation and making a hypothesis or drawing a conclusion
    - Learning outcome
14. Post activity cleaning, care and storing of tools, equipment and materials
15. Precautions
16. Other aspects that a module can incorporate or use to enrich the learning experience such as:

Hand skills	Socio cultural linkages
Knowledge	Self learning activities/ideas
Activity sheet	Photographs
References	Related activities
Children's writings	Art work and models
Work sheets	Film and documentaries
Concept maps	A task and its relation to subject knowledge.

2. Learning for Tomorrow

As teachers, we carry the responsibility of satisfying the curiosity of children, facilitating academic learning, grooming for responsible citizenship, preparing them for tomorrow. The last of the above, in recent times, seems to have gained much significance – at least from an ecological and sustainability perspective. Although one cannot predict the future, some ecological, economic and social setbacks are beginning to seem certain. Possible solution lies in our world view and how best we can create a situation that will be closely aligned to ecological principles of living. All across the world today, this reality is slowly but surely creeping into public consciousness. How smooth the process of our attunement to such a life will be would be determined by how prepared we are for such a task. And nothing comes closer to such a preparation than tending a garden. *It is in gardening that the language of nature speaks.*

A garden system provides ready and living examples of interconnectedness, inter-dependence, scale and limits; it reveals the cyclical nature of all systems, diversity, sustainability, succession, community, habitat and niche. It sets the stage for growing up to be informed, knowledgeable, responsible citizens living by the values of freedom, non-violence, equity and justice.

A schoolyard garden can be a living classroom, one where life's lessons are learnt and lived; a fertile ground for continued exploration; and, a conducive space for hours of learning without burden or boredom. Most importantly, it builds the necessary skills that would hold students in good stead for a life to be lived on ecological principles.

I. The Schoolyard Garden

Teachers and students working alongside in the schoolyard garden at Anand Niketan

Gardening can be a very exciting activity for children (and adults) of all ages. In the past, the picture of a typical school in a textbook depicted a modest building facing a garden patch with the central space allocated to the flag post. Many government run schools in the countryside, even to this day, follow this architectural norm.

However, the concept of a school with a garden tended by children has been lost in the past few decades. The focus on bookish learning has taken precedence over all else. Given the pressing needs of our times, it maybe worth our while to consider the idea of tending a garden in the schoolyard once again. This time around, it may be an educational imperative!

A garden where children and teachers work alongside, tending to plants that yield edible leaves (greens and salads), flowers, fruits and berries; send out an open invitation to birds, butterflies and bees, ants and termites, worms, snails, toads and snakes; provide a sense of purpose and achievement, is a joy. Above all, a schoolyard garden provides an ideal context to learn about the world we live in and our own role in it.

(i) Building life skills

A schoolyard garden helps to build life skills in children. They develop personal and social capacities such as managing work, working together, understanding the task at hand, planning and organising tasks, taking responsibility for personal and collective action etc. As the teacher works alongside, children get exposed to working on equal terms with older people.

Through gardening there is much opportunity to create interdisciplinary curricular linkages, thus linking various academic subjects to real life situations. Initiating a discussion on the needs of plants highlights a basic fact that plants like humans are living beings. Drawing attention to a sick and a healthy plant of the same variety can lead children to understanding a plant's needs which can then be extended to the larger plant world.

(ii) The schoolyard garden as an open sky classroom

The schoolyard garden, as many schools that nurture one will vouch, is a vibrant space – one which provides a living environment to investigate the myriad nuances of the world we live in. Particularly for a child, the direct connection with the living world makes for a learning journey filled with expectation, excitement, adventure and most importantly, a sense of achievement.

A schoolyard garden puts the natural world at the disposal of children – to nurture, observe, investigate, manage, *manipulate,* experiment, experience, enjoy. This living laboratory offers a context to explore areas of knowledge that would otherwise have to be accessed under various academic disciplines from dry textbooks in a disconnected piecemeal manner,

The best part about growing a garden is that it can thrive in any kind of weather – you can have one to suit your agro-climatic bioregion. It does not pressurise the teacher to be equipped with previous knowledge of gardening. With a little interest and effort anybody can grow a garden. Space too is not an impediment. One can start a garden even in a shoebox! The range is wide – a discarded container, the vertical wall space, the classroom windowsill, the corridors, the school terrace/rooftop, and for the really fortunate a dedicated garden space within the schoolyard. It is only a matter of starting one. Once began, the enthusiasm among children is contagious. The green bug does not discriminate. It will soon infect all.

(iii) Creating a schoolyard garden

Some concerns that are bound to spring immediately to a teacher's mind at the very idea of a schoolyard garden are:

Physical space

Skills in gardening

Fitting the activity into an already busy class schedule

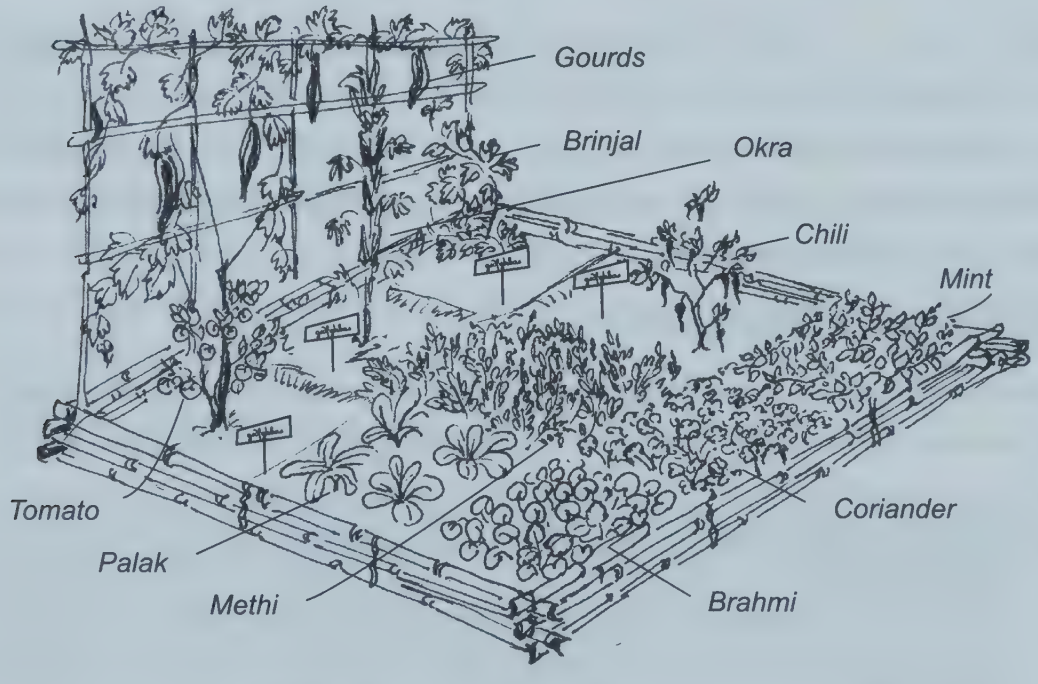
Managing a group of children in an outdoor environment

Finding the time, energy and motivation for yet another activity

Monetary implications.

Let us examine each of these concerns a little more closely.

Physical space: Most schools in rural areas and small towns tend to have some open space within the school premises that can easily be allocated to gardening activity. In the absence of this, one can explore the possibility of using a common space belonging to the panchayat/ municipality/corporatin, a park or a space belonging to an individual or an institution in the neighbourhood.The use of such a facility will require negotiation skills on the part of the school/teacher. The problem of space may-be more relevant to a city school, in which case, the same suggestion holds good. If this is not possible, the problem can be solved in many creative ways. One can start a small *square foot garden* on the terrace, in the corridor, in a container, pots on the windowsill, in shoeboxes, cartons, polythene bags, plastic bottles, old cut tyres and even in old rubber rain boots. Many city dwellers are today setting up gardens making use of vertical spaces supported on bamboo trellis frames. Aquaponics, a method of gardening, is also gaining in popularity.

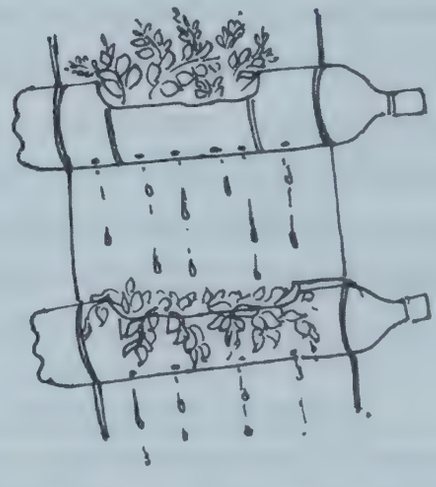


Growing a variety of vegetables in a limited space: square foot garden

Skills in gardening: The best part about gardening is that anyone with an interest in growing plants can start one without any prior training or experience. Fortunately, for the likes of such, there are plenty of easy to follow instructional books, not to mention the amount of material on the

subject available for free on the internet, including videos. Apart from this, closer at hand would be a knowledgeable neighbour, colleague, school parent and the school gardener/caretaker (*mali*). In-fact the school *mali* would be the best resource person readily available at hand. Many schools that engage in gardening activity have on their staff a fulltime *mali* as the co-teacher. (This also establishes in the minds of children that there is much one can learn from a person who is otherwise considered to be attending to a lowly job.) Help can also be sought from the local agriculture, horticulture, sericulture, apiculture departments and colleges. Expertise in these areas is available at the panchayat level upwards. Also gardeners who maintain municipality/corporation gardens and parks are extremely skilled. They would be more than willing to assist. The same holds true for local farmers, members of local gardeners' clubs and farmer associations.

Fitting the activity into an already busy class schedule: Negotiating through an already tight timetable can be a major deterrent for starting a schoolyard garden. However, many practicing schools have adopted various methods and time ranges – from specifically allocating one to two periods per week for gardening to earmarking the last couple of periods of each schoolday for a combination of skill based activities (indoor and outdoor) such as gardening, cooking, waste management, productive/creative work, computer class, art, theatre etc. Some schools use outdoor work including farming as the central theme for all academic learning. In such cases, children spend roughly half the school day on these activities. Schools where gardening is being practiced for many years have scheduled the timetable such that it varies with seasons, weather conditions, activity in the garden/farm. In such schools self reliance is a strong ideology, where children along with teachers participate in the upkeep and cleanliness of the school premises and classrooms. Here cleaning is done at the beginning or end of the school day. This is linked to the school's waste management practices of composting, recycling, care and maintenance of the cow house and biogas plant, care of pets and animals as well as running a school kitchen. Such schools are usually situated in rural or semi urban areas; are based on strong ideological moorings such as gandhian, indian or a religious philosophy; have highly committed and motivated staff; and, are usually affiliated to the school boards of their respective states for academic accreditation.



Planting possibilities: used pet bottles

What this indicates is – it can be done! However, each teacher will have to find what works best for the school and/or the class. The class teacher will soon be able to figure this out in a very short time. It is best for the class teacher to lead the garden class with the assistance of the co-teacher (or *mali*) incharge of gardening.

Managing a group of children in an outdoor environment: Any teacher with no prior experience is justified in being a little unsure about managing a group of children outdoors.The

Planting possibilities: used tyre

possibility of children wandering away, other *distractions*, disturbing other classes, getting careless with tools and materials, chit-chat etc., are real. For things to go as planned, a teacher will have to fall back on techniques of indoor group management with suitable adaptations. Having the entire activity meticulously planned and clear in one's own mind; keeping all the necessary materials ready in advance; pre-planning the activity with the gardening teacher, senior student, or the parent volunteer etc., will give the teacher the necessary confidence to manage children outdoors. Breaking up the entire group into smaller teams, assigning clear tasks, pre briefing on the activity, clear instructions on rules and precautions further aid is successful class management. Splitting the class so as to enable working with manageable numbers, rotational team work for particular tasks, or combining two classes to have two teachers between large groups are also options to consider. A well prepared and rehearsed activity plan, practice, and post activity self appraisal will help. With time and repetition all will fall in place and ease the anxiety.

Finding the time, energy and motivation for yet another activity: On the face of it, gardening seems like an added task within the timetable. However, schools that have incorporated gardening as part of the regular school curriculum view it as a pedagogical tool to integrate several academic subjects and topics. In fact, some schools vouch that academic topics come to life and bear direct relevance to pupil's everyday experiences when introduced through an integrated approach – the entry point being gardening. Garden activity has been used effectively to deal with topics in language study, mathematics, science, history, governance, geography, economics, art, craft, culture studies, health and nutrition, wellbeing and home remedies, environment studies, wildlife and natural resources and natural phenomena. Although it may seem like an independent activity, gardening can be used to integrate academic topics that mesh into one another quite naturally rather than handling them as cut and dry academic topics with little relevance to daily life.

Monetary implications: A garden can be started with very little money. If at all some finance is needed, the school/teacher can prepare a list of things that will be required to begin a garden. Parents, local philanthropic institutions, individuals, alumni association, the parent teacher association etc., can then be approached for contributions in kind or for donations. Many of the tools and implements maybe obtained in this way. Also various government departments have several schemes for school activities. Local offices representing the departments of Education, Agriculture, Forest, Environment, Pollution Control Board, National Green Corps, Science and Technology etc., too have provisions for encouraging such activities. So do local industries that have allocations under their CSR (Corporate Social Responsibility) schemes. Many of them have funds that are many a times left unutilised.

Supplements to nourish the soil can be prepared *in situ*, so also pest repellant formulations and growth promoters. Seeds and nursery plants can be obtained locally from local farmers, gardeners' clubs, agriculture department etc. At a later stage, the sale of surplus produce can be a source of some funds for recurring expenses.

Having now dealt with all the possible blocks that a teacher/school may encounter on the way to setting up a schoolyard garden, we can now go about actually starting one. Although there is no one type of garden or one set protocol for setting up a successful schoolyard garden, the pointers given here will help establish one that is suitable to a teacher/class/school. The key is to *start small, take it step by step and do it together*. An open mind, plenty of support from local practitioners and books, a willingness to experiment and learn will help greatly. A teacher will have to be patient, keep expectations low, keep a close watch for the slightest indication of possible failure, be prepared for disastrous results sometimes, watch out for pests and animal attacks and be prepared to retry several times until success finally arrives. It is important to keep the enthusiasm levels of the class high and not let failures detract yourself or the class. Nurturing a garden is a reward in itself.

Planting possibilities: bamboo basket lined with plastic sheet

Some of the benefits of a schoolyard garden are:

Unfolding the principles of ecology in a living environment

Hands on learning with tangible outputs

Linking academic learning to life processes

Establishing the living systems world view and the connectedness of all life processes

Learning about the cyclical nature of life processes

Building skills of cooperation and team work for common goals

Linking learning to local community livelihoods and needs

Placing the student at the centre of all activity

Providing an opportunity to work alongside the teacher

Collectively taking ownership for the results

Gardening has proven psychological benefits for all, more so for hyperactive and differently enabled children.

A schoolyard garden cannot function in isolation. It will at some time, sooner or later, have to seek support and interact with the school management body, the parent-teacher association, local government, public and private institutions, community experts, parents, volunteers. A garden expands the interactive space of the school, the teachers and the students to the entire local community.

(iv) Setting up a schoolyard garden

The foremost task for a teacher is to decide the kind of garden that suits the purpose of the students' learning needs, their age, skill levels and the class size. It is best to start small, spend

Planting possibilities:used jute or plastic sack

some time in planning on what you would like to see happen in three years and then plan for the current school year; further, breaking it down to season cycles. Since the school year is interspersed with holiday breaks, this too must be considered in the plan.

Ecological audit: While starting a garden it is essential to bear in mind that in creating a garden space, we are interrupting an existing pattern of life. Hence before changing/clearing the de-marketed area it would be interesting for children to make a close observation of the area and note its existing features including plant and animal life, water bodies and creatures within it prior to making any permanent physical changes. This is known as an *ecological audit*. Conducting such an audit will help children become aware of the existing ecosystem, the diversity and interdependence of flora and fauna as well as the food webs already in existence.

Site selection: The selected site should be user friendly and manageable. Since we are dealing with living systems here, it demands frequent visits. As one cannot move plants in mid growth, the selected space should ensure permanence for at least one growing season of the planted crop.

While preparing the garden site, it is essential to make a detailed survey; refer to the *ecological audit* to evaluate what we have and what we need, including the need to construct bunds, gutters, trenches, water channels, gulley plugs, water drainage provisions etc. The possibility of using greywater from the school kitchen and the washing area in the garden should be also explored while selecting/planning the garden site. This water, if of suspect quality, can be used for watering the green hedge, timber, fodder, fuel-wood and biomass yielding trees. Below are a few parameters to consider while selecting a garden site.

Size: As stated before, the size depends entirely on the purpose for which the garden is being set up. It is best to discuss this further with the school principal /and an experienced gardener before a decision is made. One must start small, with enough space for all children to work individually, in pairs and in small groups.

Soil type: This plays a major role in the type of garden one can grow. If the soil is not ideal, the ground may have to be prepared suitably by weeding, cleaning, turning the soil, clearing it of large stones and pebbles. Further enriching it with green mulch, compost, farm yard manure and soil nutrient formulations if necessary.

Topography and drainage: The kind of landscape will determine the type of garden you can grow. The slope of the land as well as the porosity of the soil will have to be considered in the design as drainage of water is crucial to gardening. Plant roots rot in the absence of a gradient to drain excess water that the plants receive either from rain or when hand watered by students. Avoid low areas where water will collect in wet weather. Plain raised areas are the best. Unless terraced, avoid steep slopes as far as possible.

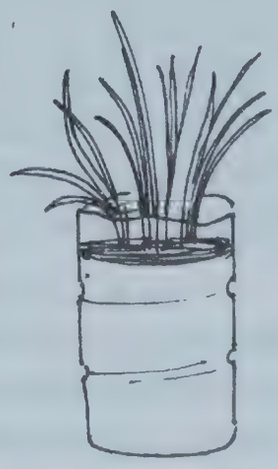
Sunlight: Most leafy vegetable, fruiting and flowering plants need some amount of direct sunlight during the day. It is essential to study the garden site for sunlight during different times in a day, and, if possible, during different times of the year. This could be part of the preliminary study assignment for slightly older children prior to starting a garden. The areas receiving shade can be allotted for the tool-shed, demonstration, teaching and observation areas, washing and cleaning areas, for growing shade loving plants, and, the plant nursery.

Water: Regular watering of the garden is essential for healthy plant growth as well as for a good harvest. The water source should be at a convenient place with easy access such that students can water their garden beds with ease. One may at a later date choose to go in for various methods of watering the garden beds for demonstration and experimental purposes or for convenience. In the initial stages all children should learn to water their garden beds so as to learn the skill of watering correctly.

Access: Having the garden plot near to the classroom has many advantages, especially with younger children. It is easier to connect garden activities to the curricular content as well as tend the garden on a regular basis. For very young children, even planter containers (plastic-sheet lined cartons, bamboo/reed/cane baskets, shoeboxes) placed outside the classroom work very well.

Visibility: It is good to give the garden a central location in the school landscape. Visibility makes the task of gardening more interesting, building a sense of pride in the children. It also helps to watch out for monkeys and stray cattle/goats that may want a share of the produce. From a safety point of view too, it is essential to have a garden at a visible location form the class, staff or office rooms such that it is always in the sight of adults passing by.

Security: One can make use of existing fences, trees or hedges in selecting a garden site. It maybe useful to have the area fenced appropriately. Green hedges provide an excellent niche for many bush nesting birds. It enhances the quality of a school garden to have a green hedge that attracts birds, bees, butterflies and other insects and small animals that assist in pollination and propagation. One needs to decide for oneself the kind of security that is appropriate. It is essentially to keep the garden safe from attacks by rodents, hens, peacocks, cattle, pigs, bats, monkeys etc. It should also be safe from possible theft and vandalism.



Planting possibilities: cut pet bottle

No two schools, teachers or classes will have similar gardens. Only with experience will a teacher know the kind of outdoor learning space that suits the needs of the class. Taking note of the above points may help in providing some ease in planning and execution of the task.

The garden design: This will depend on the purpose the garden is meant to serve. The design maybe evolved collectively by the pupils, teacher, principal and a local gardener/volunteer practitioner. Designing the

school garden can be taken up as an assignment by the higher classes as team or group task. Creating a garden plan/map with dimensions provides ample scope for using geography, mathematics and science. Apart from making provisions for growing, washing, storing and demonstration areas, it will also have to provide for garden paths, take into account sun (and shade), rain, wind direction, terrain and soil structure, vegetation in the vicinity, access to water etc. All the design plans can then be displayed on the notice board for a few days, inviting feedback. The best elements from the designs created by all the classes/teams can be then finally selected to create a final design.

Planting possibilities : nursery bag

(v) Essentials in a schoolyard garden:

A typical schoolyard garden design will have to be child friendly, provide areas for observation, demonstration, discussion as well as garden work. Although a garden can be of varied types, the emphasis here is on a typical *edible* garden plot that is easy to grow and maintain, providing ample opportunity to primarily meet the educational needs of students. A schoolyard garden would incorporate space for pathways, plots/beds, washing area, a tool room, a demonstration area, a water source, common growing area, experimental plots, space for creepers, trailers, shade and water loving plants.

Fencing: The primary purpose of a fence is to protect the growing plants from being eaten, destroyed or damaged. A fence can be of different kinds based on the function it is meant to serve. Fencing can be expensive, especially if built with concrete, made with poles and barbed wire, wooden or bamboo styles etc. A green hedge or a hedge made with local variety of dry thorny twigs is economical. However, all need maintenance and upkeep.

A fence is generally raised/grown to keep out stray animals and large domesticated birds, protect against possible theft or vandalism. Ground birds such as hens (and ducks where their rearing is common) generally sneak in from the gaps, in which case, the fence will have to be such that the birds cannot see what is in the garden. Of late many have found that old used *saris* tied to poles around a garden bed do the job of blocking their vision quite well. In case one desires to protect the garden from burrowing animals such as rodents, hares, mongoose, porcupines etc, then the foundation of the fencing needs to be fairly deep. Waste sharp rubble from renovation sites can be placed in the foundation of the boundary to detract rodents and burrowing animals from tunneling into the garden. On the other hand, if the attack comes from arboreals like monkeys and large birds such as peacocks, one may need to fence the garden with a grille enclosure having a grille roof. This will of course come at some cost.

It is essential to bear in mind that the type of fencing depends on the type of threat one is attempting to address. The simplest answer is to seek local solutions and local guidance on the matter. Whatever the choice, a fence can be used to also trail vegetable (bitter gourd is safe to grow as cows do not much care for its taste) or flowering creepers, grow a vertical garden, improve the aesthetics of the school with colourful murals, garden boards, sign posts displaying *green messages* etc.

A hedge fence also serves the dual purpose of an ideal nesting site for many hedge-birds such as babblers, robins, bulbuls, sparrows, sunbirds, munias and several other species as well as ideal egg laying sites for butterflies, beetles and insects and as nectar repositories for bees. A green hedge attracts many natural insect pollinators so very essential if one is growing vegetables and fruits dependent on such pollinating agents. A green hedge is an excellent live laboratory for topics in natural science and habitat study.

The location, size and height of the garden gate is to be carefully decided to suit requirements. It maybe best to wait and watch carefully before opting for a fence that may incur a great expense for the school. On the other hand, if the school campus is well protected by a boundary wall or compound, the fence could be a low one meant for demarcation rather than protection.

Garden paths: The paths within a garden serve multiple purposes apart from access to the garden beds. They will be much used for going about with ease by groups of pupils during the garden activity of planting, watering, applying manures and other inputs, weeding, plot preparation, harvesting etc. Paths should also provide space for pupils to work with ease while attending to their beds/plots. Too narrow would make children jostle for elbow space while too broad would be a waste of precious growing area.

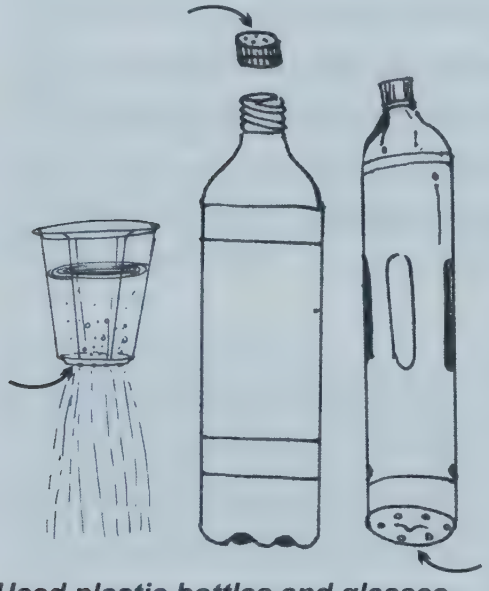
Garden paths after every two rows of beds make it convenient for children to work in the garden; also seen are the various methods of watering

Garden beds/plots: The ideal bed size for growing a patch of vegetables is about 3 feet wide depending on the age of the pupils as well as the crop being grown. A good rule of thumb to follow is to maintain a width such that children can reach over half way across the bed from the garden path. The length maybe a little more flexible extending upto 8 to10 feet more or less. Such plot sizes are ideal for children to tend the garden with ease on a regular basis.

Meeting cum demonstration area: Since the primary purpose of a schoolyard garden is educational, it is essential to have a dedicated area within the garden where demonstration of several gardening procedures and science experiments can be conducted. It can be in a shaded corner of the garden with easy access to a stored or a running water source. This can double as a display or sales area when required.

A constructed platform about 3 feet wide with a stone slab surface would be ideal for the purpose. It is easy to clean and is weather hardy. Even discarded old classroom or laboratory tables that can be repaired and painted to resist rot and rust can be reused. Such tables can be placed on kiln fired or cement bricks to avoid damage to the base of their legs.

Common growing area: Apart from dedicated garden patches, schoolyard gardens need common growing areas that are demonstration patches, experimental plots or areas for growing theme based plots such as shade loving plants, creepers and trailers, herbs and medicinal plants, nursery area, flowering and ornamental plants, plots to attract pollinators – birds, bees, butterflies and other insects. A garden space will have to be allotted for senior students who may wish to conduct specific experiments.



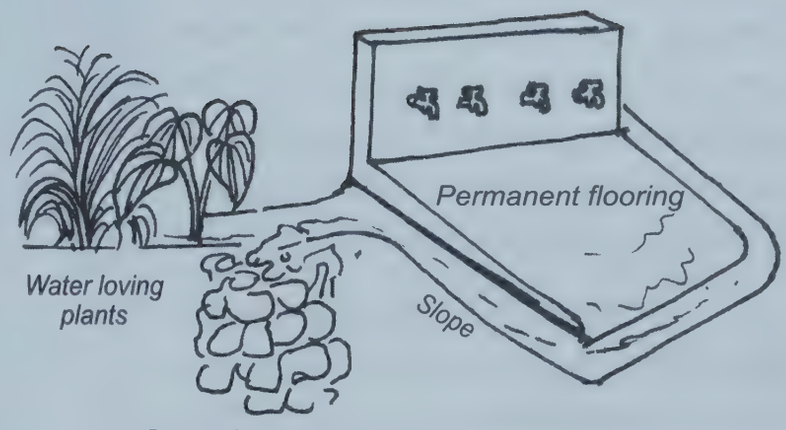
Used plastic bottles and glasses with perforations

Water: Adequate water availability is a key factor for any gardening activity. Access to water in a school garden must be convenient as many pupils will require it at the same time. Distance from the water point to the garden bed is also a consideration. Watering maybe done using watering cans or with mugs using water from a bucket or tub. Some delicate saplings may require to be watered using a spray gun. Pupils can make these by perforating either the base or the cap of discarded plastic bottles. Little children can be given small watering cans or handmade spraying bottles. Some thought needs to be given as to where the main water source is to be located in the garden – preferably at a central location. It can be designed to provide water from multiple faucets at the same time. As this area is likely to get muddy and slushy as well as crowded, the space around it can be laid with paving blocks or locally available stone slabs. It can be designed such that the excess water percolates serving as demonstration of water harvesting for groundwater recharge. Close to the watering area one may also cultivate a plot of water loving flower and vegetable plants of the local variety. Since the area can develop moss and get slippery if not regularly cleaned, children must be given precautionary instructions so as to avoid mishaps.

Washing area: After garden work there maybe a need to clean tools, wash hands, feet, footwear etc. It is useful to have a separate area for this with at least 3 to 4 faucets arranged in a row if space and funds permit. This area too like the garden water source can have a provision for a groundwater recharge drainage system, patch of water loving plants, safety instructions and cemented/permanent flooring made of local stone. It maybe a good idea to locate this area where there is maximum duration of direct sunshine as it will help to dry the place quickly. Also tools can be left nearby to dry before returning them to the tool room/shed.

While deciding on the location of both the garden water source and washing area it is

necessary to consider the direction of the slope of the land. The area receiving maximum sunlight must be selected.



Ground water recharge pit

Washing area

Tools and storage shed: It is convenient to keep all garden tools, implements, work gear, as well as seeds, dry manure etc., at one central location, preferably within the garden or nearby. This shed or building must be leak and rodent proof and should be well maintained at all times. Teams of senior students can be made incharge of it on a rotational basis. Since garden tools are simple tools, their maintenance is quite within the scope of children themselves. All things in the tool shed must have their designated place on the floor, walls, cabinets or shelves. A pictorial map of the tool shed with location for various tools can be put up at a prominent place within the shed. All students and teachers should be given regular briefings on the correct use, maintenance, cleaning and storage of tools. Junior size garden tools are available in the market. If funds permit, these maybe procured for younger children .

The quality and quantity of tools may depend on the scale of the garden as well as the budget. It is better to invest in good quality tools as they will stay longer and will be better able to withstand frequent handling by various groups of young children.

Some equipment like sprays, brooms, improvised containers for compost etc., can also be made by children by recycling available materials. Initially, it is better to keep the inventory limited and expenditures low. One can also undertake a fundraising exercise or donation drive for equipping the tool shed. The tool shed will need to be *put in order* regularly for optimal functioning.

A visit to the science museum to learn about garden tools

Communication: In the garden, a blackboard would be necessary for drawing pupils' attention to certain details. A notice-board likewise serves the purpose of displaying certain common announce-ments regarding events, information for pupils as well as visitors. Noticeboards should be weather hardy and rain proof. Sign boards for drawing attention to salient features in the garden would enhance the

educational value of the garden. These could be artistically made by pupils out of discarded packaging, wood planks or any other water proof material. If written with waterproof paints, they can be used for more than one school year. Garden signs give the garden an independent identity as an outdoor learning space. Sign boards on each tree with its local and botanical name as also its unique features, in two or more languages, can be an excellent learning tool. Children will naturally begin to learn the names of plants and trees and their features without much effort.

Scarecrow: A well made scarecrow placed at a prominent place in the garden could ward off many birds especially during fruit bearing time. It also adds an aesthetic value to the garden, children enjoy looking at one. Some birds and squirrels may also wish to use it as a perch, thus giving children a chance to observe them at close quarters.

Bird baths: Broad and shallow bowl like containers can be used as a bird bath. These are generally placed in open areas on pedestals or just above ground level for birds to visit for a dip or for quenching thirst. Most birds love to bathe, especially in hot weather. Bird visits to the garden are helpful for pollination and seed dispersal as well as for keeping a check on caterpillar populations. Also once they become familiar with human presence in the garden, birds tend to loiter around bird bath and bird-feeder areas. If in a group, they can also display playful behaviour. All this makes for an exciting experience for young children. Older pupils will benefit from the chance to observe bird behaviour at close quarters. Readymade clay bird baths are also available. Bird baths can turn into potential sites for spreading illness among birds or turn into mosquito breeding ground if not cleaned regularly and refilled with fresh water. The task of their maintenance can be entrusted to older pupils. They can adopt a bird bath by rotation; maintain a bird bath diary for the period etc.

Bee box: Bee keeping is an extremely educative hobby. Bees are social insects, highly evolved in community living. They display well organised behaviour with pre-designated roles which can be a good example of team work for children. A bee box in a garden will provide the school children with honey; increase the population of bees around the garden, assist in pollination leading to a good harvest. Bee keeping learnt in school may enthuse some to take it up as a livelihood enterprise later in life. Honey has nutritive and medicinal properties. A word of caution though, bees if disturbed can give an extremely painful sting. Before placing a bee box in the garden/school premises, it is essential to have a proper discussion on the issue with all children and staff. Only if one is confident that children will strictly follow rules related to a bee box must the school decide to have one. If successful, more boxes can be introduced into the garden at a later date.

Removing the fear of bees: children watch as a bee sits on a student's arm

Biomass collection: a regular routine during cleaning period

Nursery area: Most agro-forestry and fruit tree species are generally first grown to the stage of a stable sapling before being planted in a permanent place. A plant nursery is generally where the initial germination/tending is undertaken. A nursery area is ideally located in a secluded part of the garden away from direct sunlight. Since all the young saplings are at a single spot, it becomes easier to attend to them.

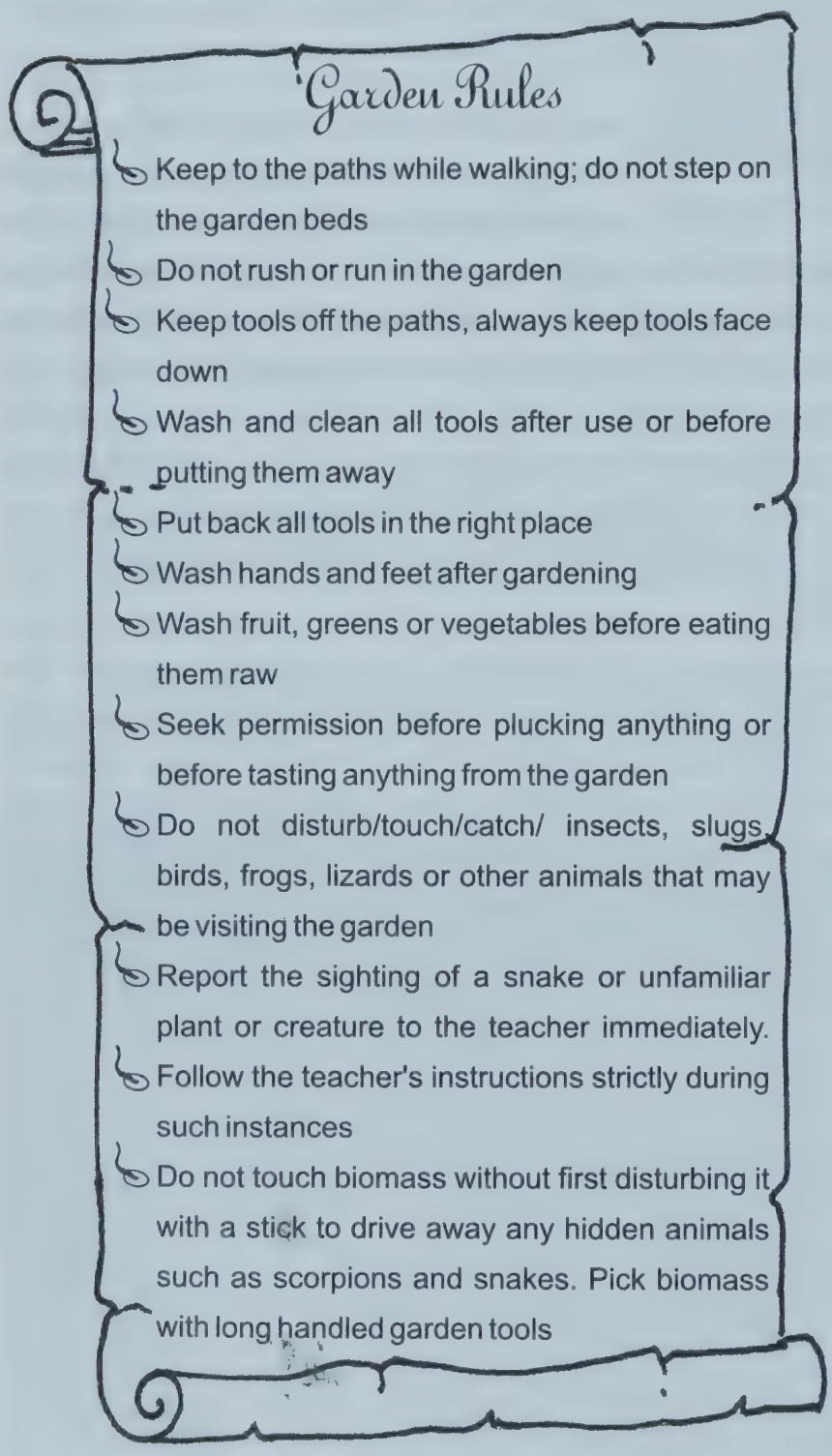
Shade and water loving plants area: If the garden has a full grown tree, the area directly under it will receive partial sunlight and will be much cooler than the rest of the garden area. In such cases, shade loving plants can be grown in a suitable patch. This area can also provide seating arrangements like rocks, a piece of log etc. for short rests. A patch of water loving plants such as banana, yam, corm, spinach vine, as well as pandals for various gourds (cucurbits) can be set up here. Herbs such as pennywort (*bramhi*), mint, lemon grass etc., grow well in water logged areas where the ground usually remains wet or/and even slushy. A good indicator for plant selection for this area would be to visit a neighbourhood kitchen garden and check what is grown in the backyard near the washing and cleaning areas. Water from the washing area in the garden can also be directed towards this patch.

Composting pit: Learning to compost is a fundamental garden activity. A garden can never have too much of compost. Composting puts to good use all the garden waste, the leaf litter from the school campus, the kitchen waste as well as leftovers from childrens' snack boxes to create excellent soil amendment inputs. A compost pit has great educational value as it demonstrates several theories of natural science while establishing the cyclical nature of all life processes. Vermicompost makes use of earthworms in the garden to do part of the job. The quickest way to prepare compost is in a large heap, but it is better for educational purposes that composting be done in small heaps by employing various locally popular methods. One can then zero-in on a method that works best for the green waste being generated in the school.

composting activity at the school compost pit

Composting reinforces first hand the value of good soil and an understanding of the critical role played by microbial flora and fauna in natural cycles of recycling and replenishment. Continued application of compost to the garden will slowly and steadily normalise the pH of the garden soil closest to ideal conditions for plant growth.

Soil input preparation areas/sheds: Apart from compost, there are numerous preparations using natural ingredients that are used in keeping a garden in robust condition. These applications make use of animal dung and urine (mostly that of cattle), jaggery, microbial concentrates, and, extracts of plant leaves, flowers, bulbs, fruit etc., as starting ingredients. Panchagavya, amrit mitti, amrit pani, vermiwash, fish and lime solution, garlic-chili solution, bio-dynamic formulations, agnihotra ash are some of many such preparations. These formulations are used for soil enrichment, as growth enhancers, bio-repellants and so on. Since many are fairly elaborate procedures that take a few days to a few weeks, a space for preparation and storage is essential. The demonstration area can be used in some instances for this purpose and the tool shed or a corner under a tree maybe assigned for their storage. These formulations can be made by senior students under teacher supervision.


Garden Rules
Keep to the paths while walking; do not step on the garden beds
Do not rush or run in the garden
Keep tools off the paths, always keep tools face down
Wash and clean all tools after use or before putting them away
Put back all tools in the right place
Wash hands and feet after gardening
Wash fruit, greens or vegetables before eating them raw
Seek permission before plucking anything or before tasting anything from the garden
Do not disturb/touch/catch/ insects, slugs, birds, frogs, lizards or other animals that may be visiting the garden
Report the sighting of a snake or unfamiliar plant or creature to the teacher immediately. Follow the teacher's instructions strictly during such instances
Do not touch biomass without first disturbing it with a stick to drive away any hidden animals such as scorpions and snakes. Pick biomass with long handled garden tools

A sample of garden rules

Evolving a set of rules: Since gardening is a group outdoor activity some behavioral norms applicable to all (especially to younger children) must be clearly put in place after a preliminary visit to the garden or prior to starting a garden. It is good to evolve these rules collectively. Each class can have a discussion to arrive at a set of rules. These can then be displayed on the notice board. Finally a set of rules can be arrived at based on inputs from the entire student and teacher community and the garden incharge teacher or an

expert gardener. It is essential to also clearly demarcate *no-go areas* with sign boards/notices for e.g., open wells, the pump house, the electrical switch board, the biogas unit, slurry pits, solar panel frames/discs, slushy areas etc. It is also essential to leave scope for garden rules to be amended/added from time to time. Strict enforcement of rules is essential in areas where children are most likely to hurt themselves or others e.g., while handling tools or sharp instruments, near the washing area, pump house, electrical switchboards, wells etc.

Garden rules are not meant to be enforced externally as that would mar the gardening experience completely. They are rather a code or practice, a culture of appropriate garden behaviour that everyone understands. However, most practices need repeated reinforcement before they can be adhered to as routine. Hence it maybe better to encourage children to make and maintain the rules themselves.

Garden Tools: Children need to be introduced to the proper handling of tools and equipment from an early age. This habit if inculcated correctly will hold them in good stead through life. Children can be introduced to tools and their uses through many creative exercises. Apart from proper handling, they need to know how to clean, maintain and store them e.g., how to stack/ put it away such that it is not dangerous to oneself or others, prevent from catching rust, put it back after use, clean or wash etc. Tools are useful items and not dangerous if used correctly. Adults and children should be very particular about this. Children learn from example and from repeated instructions/corrections. Correct conduct can be inculcated if senior students and teachers set the right example.

Older students can be involved in researching for the right quality and quantity of tools required in the garden. They can undertake market survey, order for catalogues, surf the internet for information prior to the actual purchase.

Jute sack tied to poles for carrying biomass

Some common garden tools are: spades, rakes, wheel barrow, hoes, sickles, shovels, rain gauge, compost thermometer, watering cans, buckets, mugs, pruning shears, harvest baskets, planting containers, nursery bags, brooms, twine, garden hose, garden pots, measuring tapes, marking powder etc.

Measuring and marking plots and paths with rope and chalk powder

(vi) Growing a garden:

The main task in a garden is to grow plants. One can begin with seasonal vegetables that can be harvested in 3 to 4 months. Along with this one can also grow creepers and trailers, tubers, yams and corms, herbs and flowering plants; each having their own growing durations. Herbs such as mint and some perennials grow through the year. Post harvest the beds are again readied for planting.

The produce can be cooked by the class, distributed; if in excess, it can be sold to parents and others; or, processed for use at a later date. In a garden we are dealing with living environments, hence it requires extra special care and attention.

Once the garden map is ready, one may begin with clearing the ground of large stones and weeds. Getting the fence in place can be taken up depending on the urgency of a given site. All non growing areas can be left out to be developed by and by and the task of preparing the beds can be taken up. If one is beginning a garden afresh, testing the soil for various parameters including pH could be considered as an exercise for the senior class. Examining other physical parameters like moisture content, texture etc. are useful in determining how best the beds can be prepared for optimal output.

Preparation of individual beds by senior students

Demonstrating the method of broadcasting to junior students

Preparing garden beds: The first task in the preparation of garden beds is to loosen the soil. This can be best done by batches of students taking turns over a period of few days. If a single garden space is being shared by the entire school, then the entire plot will have to be first prepared prior to taking up any other activity. Loosening the soil, breaking large clods of earth down to a uniform grainy structure can be done using spades and shovels. One may need the assistance of a pair

Weighing seeds for sowing

of bullocks or a machine in case the size of the garden is too large or the soil is extremely hard and compacted.

Once the soil is loosened, 1x1 or 1x2 metre plots can be marked using string and chalk powder. These plots can be then allotted to individual students, a team or a few beds per class as required. These individual plots are then prepared as raised or shallow beds for planting. It is essential to mark out the garden paths between beds or a row of beds. They are very essential for movement during gardening. These pathways should be minimum 2 to 3 feet wide. Laying out the beds gives ample scope for children to practice their mathematical and geometry skills, while marking the beds and examining the soil can be lessons in geography, geology, soil science (pedology and edaphology) and hydrology. The most important point to note while laying the beds is to take note of the east-west direction, and the area receiving maximum direct sunlight. The beds will require compost application and watering as preparation for planting. It maybe necessary to turn-in a short mulch crop of fast growing local legume variety to enhance the nutrient value of the soil or double digging to spread nutrients and increase soil porosity.

Teacher mixes soil with seeds to aid uniform broadcasting for a junior student

Broadcasting by junior students

Bed preparation is the most crucial step in gardening as also the most strenuous. It may take a lot of time and effort for the first few planting cycles, however with each subsequent planting, the earth will loosen up, become porous aiding easy water absorption, vertical root growth and soil enrichment. The beds will eventually become quite crumbly and porous. Over time bed preparation maybe reduced to just a couple of sessions in the garden. Healthy soil will ensure healthy vegetables high in nutritional value, immune to pest and disease problems.

W
E
West to east, top to down: gourds, okra, brinjal, chili, tomato, radish, palak, methi, mint, brahmi
Marigold, garlic, chili keep away pests

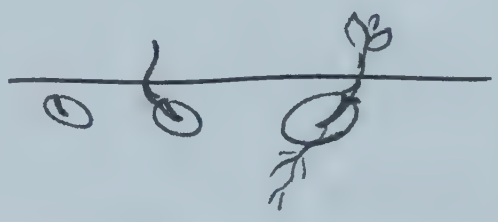
Planting to maximise the use of sunlight

Planting: The choice of a particular vegetable for growing will require some deliberation with the students. Some points one may wish to bear in mind are the duration of growth, how easy or difficult it is to grow, is it locally grown, its nutritional value, its general appeal in its raw/cooked form to children, how much of it can be used by the school, in what quantities is it required in cooking.

Having decided on some common and easy to grow vegetables such as spinach, fenugreek, chili, brinjal, tomato, lady's finger, dill, amaranths, coriander, spring onion, cluster beans, radish, carrots, turnips, gourds, mint etc. it is now time to see how these are planted and during which planting season. Having made a selection as per the season, site, soil, terrain and sunlight the required quantity of seed can be procured from a local farmer or from the market.

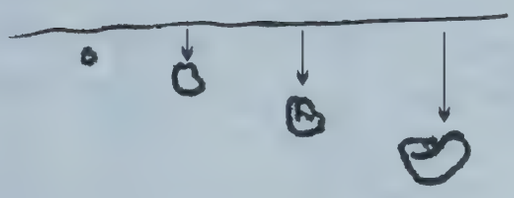
Planting is usually done by broadcasting on the surface, followed by a light cover of topsoil; sowing of individual seeds at specific distance from one another; transplantation of saplings, or by planting its vegetative parts, stalks, bulbs, bulbils, stems etc. Young children can begin with broadcasting. In case different varieties are being planted, it is necessary to plant the shorter varieties towards the east, progressing towards the west with taller varieties. For example spinach, mint, coriander, fenugreek, dill towards the east while tomato, brinjal, lady's finger, chili towards the west. This will help optimize on sunlight. Similarly, a few beds can be planted with mixed crops including a few flowering plants like marigold to maximize on soil nutrients and water as well as to ward off pest attacks.

Watering: Water requirements of plants vary for each type. It is dependent on several parameters including its root system. Specific watering routines will have to be worked out for different types of vegetables and other plants in the garden. Watering with cans has to be gentle, given to the soil and not over the plant. Young saplings have to be given water very gently to prevent damage. Early in the day or late in the evening are good times for watering the garden as loss due to evaporation is at a minimum during these times.



Germination

Mulching: Dry mulch such as hay, soft twigs, paddy husk, coconut fibre, sawdust etc., are used in gardens to protect the soil from water loss, enhance the quality of the soil



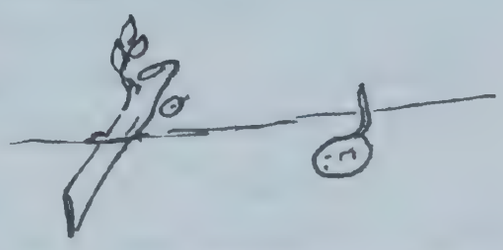
Rule of thumb: plant seed at 3 times the depth of seed size

with organic nutrients as also to curtail weed growth. After plants reach a certain height any of the locally available mulch is applied around the stem of the plant. Green mulches are generally fast growing leguminous plants of local variety found growing abundantly along the wayside and in open areas. Children can be asked to identify such plants and collect seeds. Seeding in these plants occurs a couple of months after the monsoons have ceased, closer to the end of winter. About a month prior to sowing, mulch seeds are broadcast and allowed to grow in the garden, just prior to seed setting or around flowering time the entire plant is ploughed into the soil and allowed to decompose. Since legumes are nitrogen fixers, the nitrogen content of the soil is enriched by this process. Gliricidia, a fast growing hedge plant/wind breaker too bears plenty of biomass (leaves) that decompose in a short period. This too can be applied as mulch.

Weeding: Weeds are a reality of all gardens. Only the type and abundance differs. Most weeds can be eliminated before they can become invasive by clearing the garden area thoroughly prior to bed preparation. Weeds bearing seed are carefully removed from the garden and disposed faraway prior to bed preparation. Weed biomass that is used for preparing compost must be carefully examined for seeds. No weed seeds should go into a compost pile else they will show up as weeds when the compost is applied to the garden.

Weeding is a regular garden chore that children quite enjoy. It gives them an opportunity to potter around vegetable patches, examine and observe plant growth and animal activities closely and at leisure. A good practice is to remove the weeds along with their roots much before they come to seed or even before the flowering stage. Weeds themselves can form an interesting subject for the study of plant competition. Some weeds are also beneficial as they attract beneficial insects or may divert pests from the vegetable patch. As a matter of academic interest, one bed in the far corner of the garden can be left un-weeded for comparative study.

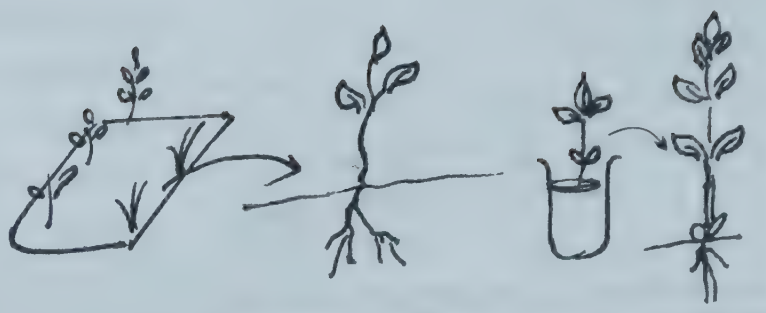
Marking plants/pods/fruit for seed selection: Seed selection is a scientific process. Middle and senior school children can be introduced to the technique of seed selection. Selecting good healthy pods and fruits requires keen observation. Tomato, chili, lady's finger (okra), beans, peas, gourds are ideal plants for learning seed selection. To begin with, the fruit/pod is identified or selected from among many others for its size, quality, yield, colour, higher nutritional value, adaptability to climate variations, resistance to pest attack and disease etc. The plant or the fruit/pod is then marked by tying a string to its stalk.



Vegetative propagation: planting cuttings and tubers

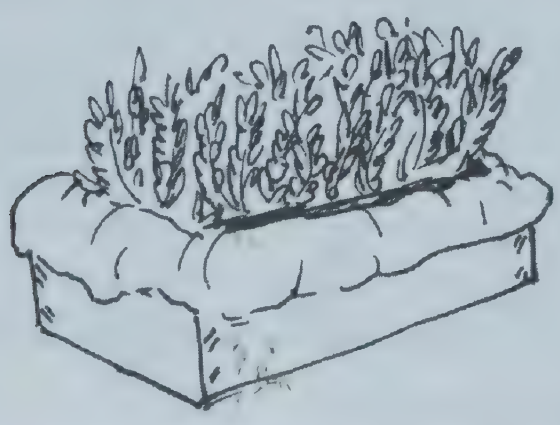
The selected fruit/pod is left to mature completely on the plant. It is carefully harvested and further processed for seed. Fully ripe brinjal, tomato are squashed and washed in

water well to remove the fleshy part prior to drying the seeds. Seeds should be cleaned and cleared of all fleshy material before drying, dried well in shade/mild sunshine and stored. Bunches of fully mature lady's finger are left to dry completely in a sunny area on a string, after which seeds are collected. The same procedure can be followed for chili. Gourds such as ridge gourd and bottle gourd are dried and stored whole for seed. Different plants have different methods for seed keeping. A local farmer seed-keeper would be the best resource person to introduce children in this activity. Once children learn a simple process of seed keeping, they can then be introduced to more complex processes of seed collection and preservation. Keeping and growing a garden with one's own seed has many advantages over seeds purchased from the market. Purity of line can be maintained if one is using seeds from one's own garden. This activity provides the perfect opportunity for the study of pollination, fertilization, flower types, pollinating agents, the significance of healthy bee populations in nature etc.



Transplanting from nursery bed and bag

Application of soil inputs: Compost, manure and green mulch are essential inputs for enriching the soil. There are several locally developed soil enrichment formulations that farmers have standardised for promoting the growth of various parts of plants at various stages. For use in the schoolyard garden, children can learn methods of preparation of some of these inputs. Biodung compost, vermicompost, panchagavya, amrit-mitti, amrit-pani are some preparations that can be easily learnt by older children. Application of biogas slurry, if available, can also enrich the soil. To begin with, if children can master the technique of composting and preparation of vermicompost, the other formulations can be tried out one by one through subsequent planting seasons or by various teams at a time. Application of these inputs to soil can be best learnt from a local practicing gardener or farmer who would be the right guide. She/he will have sound practical knowledge regarding appropriate inputs suitable to local conditions. Composting offers excellent opportunity to understand life cycles of subsoil flora and fauna and to understand soil as a vibrant ecosystem.



Planting possibilities: shoebox lined with plastic sheet

Application of growth promoters: Growth promoters are organic formulations which promote the growth of plants at different stages. These are applied to the soil or sprayed on the plant. Vermiwash, amrit-pani, panchagavya are some such formulations. Fish and egg solution, lemon and egg solution are some others. Senior students can experiment with the preparation of such formulations; undertake small scientific investigations using them in various dilutions at different stages of growth on various plants.

Looking out for infections/infestations: Like us, plants too are susceptible to attack by disease causing pathogen, parasites, bacteria, virus, fungi, insects, arthropods, nematodes, snails etc. These can attack or lodge themselves in any part of the plant – leaf, root, stem, flower, fruit. The best way to deal with it is identification of such attacks in the very initial stages of infection/ infestation. Careful and keen observation is the key. Children should be encouraged to look for the first signs each time they visit the garden. Nematodes, snails, fungi tend to attack the root system or the base of the shoot/stem. Insect attacks are more on the leaf (on the underside), stem, flower bud, just emerging fruit. All such observations should be noted down in as much detail as possible, with date, drawings, photographs, visible signs of drying, wilting, damage by boring, nibbling, change in colour etc., and brought to the notice of the garden teacher immediately. Suitable corrective action must ensue without delay.

Teacher indicates how to look for signs of pest attack

Treatment for pest/bacterial/fungal attacks: Like weeds, attack from pests is a reality of a garden. Healthy plants growing on healthy soil are able to withstand pest attacks to a large extent. Pests come in various forms. They maybe visitors that can destroy a crop over time or in a single visit or they could be lodged on the plant or under a leaf or stem, on or inside a flower, on or in a fruit or in the soil attacking the root. Pests that are difficult to deal with generally belong to the insect, beetle, worm or snail family. Looking for pests requires constant, keen vigilance. Dealing with pests can be done at the initial stage of attack by removing them physically from the plant. Some organic formulations such as chili and garlic solution, solution made from leaves of trees such as neem, leaves of locally growing shrubs which are not consumed by goats make a good broad spectrum pest repellant. Slugs and snails are best removed physically. The study of pests is an interesting topic as most belong to the insect, beetle, spider, snail family; come in very attractive colours; and display amazing camouflage patterns. Many worms live in the soil and attack roots. Some insects lay their eggs in tubers and bulbs such as potato, corm, sweet-potato etc.

A healthy soil will ensure healthy plants that can resist such pest attacks. A good way to minimize pest problem is to practice intercropping of companion crops such that they complement one another in keeping pest infestation within manageable limits. Intercropping with chili, garlic, marigold keeps pests under control to a large extent. Keeping the garden friendly to bird visits with bird baths, and bird nesting spaces can encourage birds to visit the garden thus keeping caterpillar, snail, slug, bug, beetle, ants, termites and the numerous other insect populations under control.

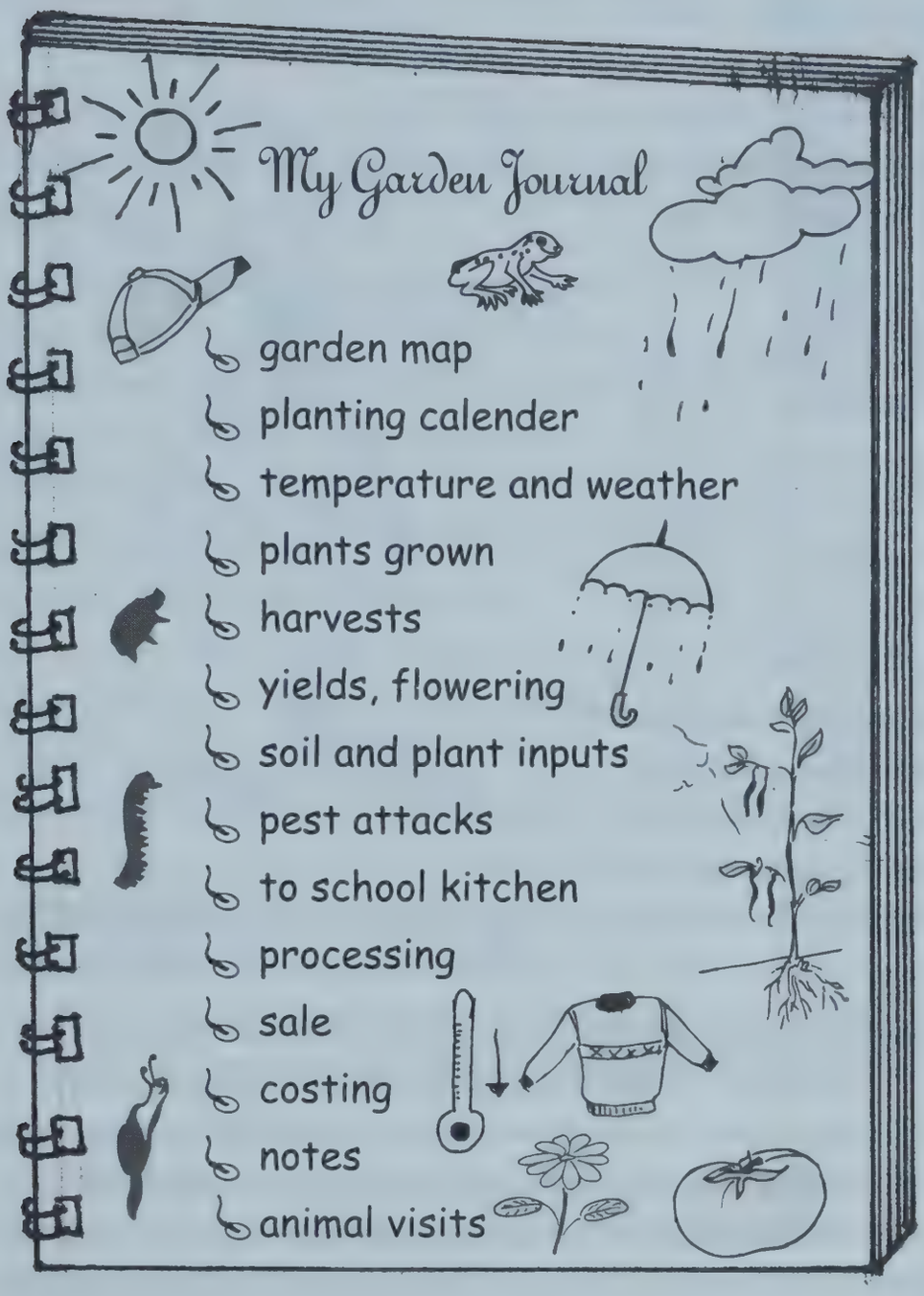
A little pond in the garden can encourage frog populations. Frogs keep insects populations under control. Rodent populations are kept in check by snakes, owls, eagles and kites. A good area for study is the animal citizen population of the garden – both resident and visiting.

Harvesting palak for the school kitchen

Harvesting: Harvest is the most exciting time for children. Vegetables and fruits are harvested in different ways. Some greens like coriander, fenugreek and dill are plucked as complete plants while spinach leaves can be harvested from the plant a few times before complete removal. Chili, lady's finger, tomato, brinjal, beans, peas are harvested as berry/ fruit/ pod; while radish, turnips, carrots are harvested as whole plants. Radish and carrot leaves can be harvested once or twice for a green vegetable dish prior to uprooting the entire plant. Carrot leaves go well in a green salad. Gourds and pumpkins are harvested individually. Harvesting vegetables, gourds, beans can be done by hand or using a garden knife. Children should be instructed correctly on harvesting procedure prior to harvests. Harvesting provides a good opportunity for keeping records of quantity grown against dates in a particular area. Many statistical and arithmetic procedures can be reinforced during harvests. Careful selection and grading of the harvest further enhances skills in understanding quality and standards.

Post harvest practices: After the harvest of any fruit, vegetable or greens it is essential to clean and sort depending on its use. In case the harvest is going to the school kitchen for preparation of a food item, a careful selection for its consumable value should be ascertained. Since children can easily take ill, all harvest should be thoroughly cleaned and washed, examined for worms and insects prior to being cooked or served raw. Sometimes if there is surplus, the class may want to take home some or even sell it to generate income towards the garden kitty. Some fruits and vegetables can also be retained in the school for preparation of sauce, chutney, jams, pickles etc. Simple recipes can be adopted for processing the garden harvest. Pumpkins, potatoes, onions, dried pulses and beans can be processed and stored for future use. The surplus maybe considered for sale. Children will gain some very valuable skills in packaging, presentation, valuation, costing, marketing, advertise ment and promotion etc., if the surplus is sold to outsiders.

Junior students watch as older children weigh the harvest



Garden journal: Keeping a garden journal or a diary is essential not only for the gardening activity but also as a component of academic rigour. Apart from serving as a reference book for future use, it provides ample opportunity for children in systematic record keeping and in developing a scientific approach.

The garden journal should include the following:

Periodic maps of the garden showing garden beds at various times of the year/in different seasons.

Indicate the terrain including rocks, slopes, mounds, hollows, burrows, anthills, water bodies etc.

Indicate vegetation, existing trees, bushes, plants, grass, weeds, rubbish heaps etc. Fences, hedges, paths, water source, tool shed, demonstration area, animal shed/pens/coops, dimensions and direction, mention soil type and soil quality if it has been tested, and, any other features.

Maintain detailed notes on all gardening activity on a routine basis as well as incidental observations such as pest attacks, unseasonal weather change etc.

Weather records including temperature, humidity, wind speed and direction, record of the feature of the sky, cloud patterns, sunshine and rain is an essential and should be made part of regular school work.

A few general observations: On an average, vegetable patches can be grown in 2 to 3 planting cycles in a school year. Some annuals and perennials may have to be tended or harvested during vacation time while others may require occasional watering during vacations.

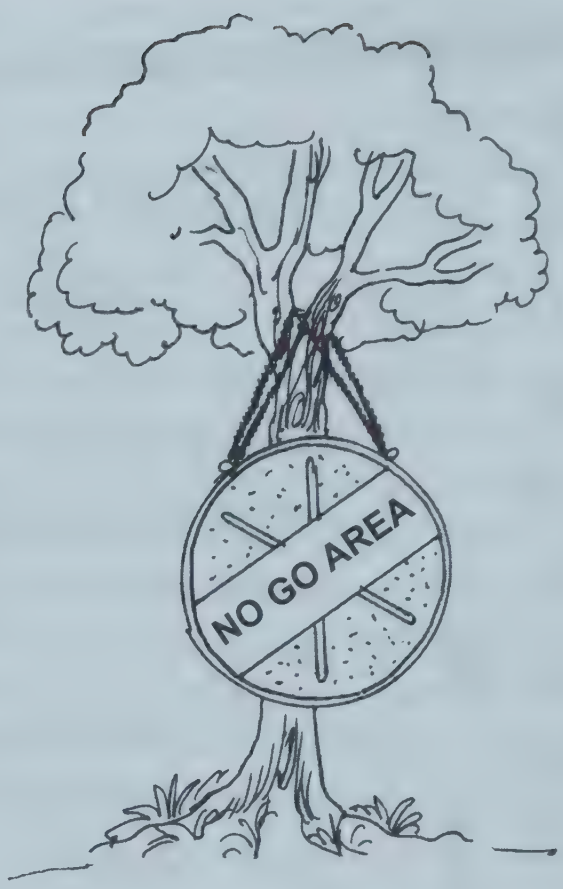
Depending on the convenience of a school a suitable planting calendar can be drawn up for gardening activity, only for the duration of the school year or extended to round the year if students,

parents, staff or community members offer assistance.

At times some beds maybe left fallow to recoup from nutrient loss. Water availability or weather uncertainties may at times cause hurdles. If all goes well, post harvest bed preparation for the next sowing can begin again.

Children may find it exciting to hold annual garden exhibitions, open up the garden for parents and other visitors. Apart from sharpening several organisational and interpersonal skills, a schoolyard garden gives an opportunity for children to feel a sense of pride in their achievement and for the parents and community to feel a sense of involvement.

A garden provides an opportunity to explore other areas of academic interest that delve into areas such as food and nutrition, energy, local cultural traditions, democratic decision making, water, waste-management, self-sufficiency, recycling, economics, sustainability, ecological concerns etc.



It is important to put such prominent notices near open wells, pump house, electrical switch boards, slurry pits, solar panel areas etc.

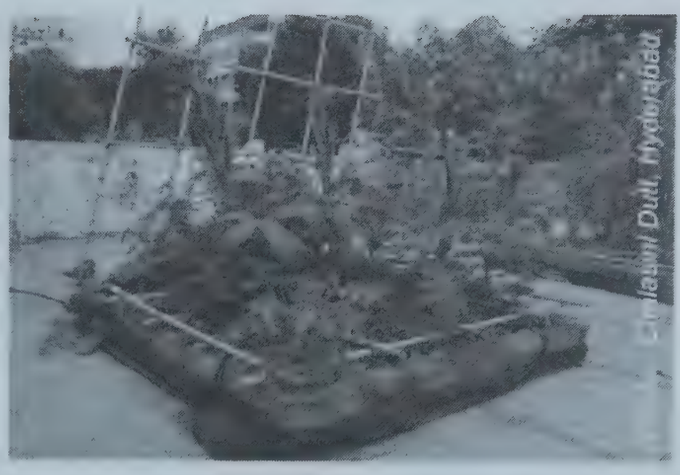
While creating a school garden it is essential to keep in mind the nutritional requirement of young and growing children as also inculcating in them the habit of taking a wholesome meal. In deciding what to grow in the garden, it maybe good to identify the local variety of vegetables and fruit that grow easily, identify the nutritional and dietary needs of the children, general dietary deficiency in the locality, find out the dietary habit of the area, identify easy to grow local foods high in nutritional value, also look for general trends of malnutrition, under nutrition, over nutrition and look for indications of deficiency of micro-nutrients in children. This can be linked to complete and wholesome dietary needs of children which includes cereals, roots and tubers, legumes, oil seeds, nuts, oils, fats, vegetable and fruits, animal foods (if part of the diet) and plenty of water. The emphasis should be on variety in the diet, so that all the dietary needs can be met.

What is grown in the school garden and what is consumed by children should enhance nutritional intake. At the same time, selection is to be made such that the crop is reliable, hardy and easy to grow. It should also not need too much work and time and should be well adapted to the local climate, soil conditions and in line with the water availability in the garden.

The last harvest should ideally be 4 to 6 weeks before the end of the school term so that it allows time for harvest, cooking, consuming, storing and preservation if necessary. It also provides time for writing of records and appraisal of the year's/term's garden activity.

(vii) Special garden designs and theme gardens

Special garden layouts are educational, symbolic, stimulating as they break the routine. Some garden themes that can be explored are:



Square foot terrace garden.

1. Square-foot garden

A square-foot garden is a one metre square patch which is divided into nine squares of one square foot area each. Within these nine squares different mini-crops can be grown. They make an interesting patch for children to observe and compare a variety of crop plants at a single site. Square-foot gardens can be grown if space is a limitation.

2. Vital micronutrient theme gardens

The body needs vitamins and minerals regularly in miniscule quantities. Many fresh vegetables and fruits provide us with these. Growing a theme garden of these plants encourages children to make such foods a part of their regular diet. Children can also learn about illness caused by a deficiency of these vital ingredients in diets. It helps to build good dietary habits.

Vitamin and mineral theme gardens are excellent for encouraging children to eat wholesome diets for healthy growth. For instance a Vitamin-A garden patch can include papaya, spinach, carrots, dark green vegetables, pumpkin, sweet potato etc. Similarly a vitamin-C garden can have citrus fruit trees such as various varieties of lemon. Children can be encouraged to investigate plants rich in other vitamins and minerals to create such theme gardens.

3. The health-punch garden

Children can grow a combination of fruit, vegetables and salad greens such as papaya, banana, cabbage, carrot, brinjal, spinach, tomato, mint, coriander etc. It encourages children to include salads, cooked vegetable and fresh fruit in their daily diets.

4. Heritage garden

Many traditional farming families have, over generations, carefully selected and maintained special variety of seeds of grain, oil seed, spices, fruit and vegetable. This has been done keeping in mind their unique traits of taste, appearance, nutritional and/or medicinal value, yield, keeping quality etc. Seeds of such varieties of foods are known as heritage seeds. Children can be encouraged to identify such local farmers, collect seeds of such plants and grow a heritage garden.

This activity can be an entry point for senior students to investigate many aspects of the complex traps that farmers in India and across the world find themselves in today with a few multinational companies wanting a monopoly on seeds, introducing genetically modified foods, hybrids, use of pesticides and fertilisers, intensive irrigated agricultural practices, agriculture policy

etc. Younger students will find the activity interesting for the intrinsic value of the heritage nature of these plants.

5. Ecosystem garden

Students can be encouraged to create garden patches that reflect unique characteristics of particular ecosystems by growing succulents, xerophytes, aquatic plants, grasses etc. These can be live laboratories for ecosystem study.

6. Market garden

As an experience in maintaining a garden as an income generation activity, senior students can grow a crop based on its marketable value. Some aspects that this exercise will offer children hands on experience in planning, market survey, product selection, production, sales and marketing, packaging, product promotion, calculating profit/loss, managing money, record keeping, accounts, decision making etc.

Other garden themes that students can explore are medicinal plants garden, herb garden, berry garden, water loving plants garden, keyhole garden, spiral garden, dry land garden (with draught resistant varieties of plants such as millets, lentils, lady's finger etc), a garden with multiple varieties of a particular food such as brinjal, tomato, chili or a garden with various edible plants belonging to a single plant family such as cucurbits are more themes that children can explore.

(viii) Some notes on pedagogy

The notes below are offered in graded stages that a teacher can use to initiate gardening activity with students and build on previous experience to progress from simple to complex tasks. This is only one of the numerous paths one can take to approach the topic.

1. Introducing children to gardening by drawing on linkages between one's surroundings (ecology and environment) and oneself can be approached in many ways. For instance, the teacher can begin by drawing the attention of students to this topic by initiating a discussion on me and my need for food. This can lead to a discussion that could conclude with how and where food is grown. The teacher can further suggest a visit to a nearby farm or a vegetable garden in the neighborhood or the schoolyard garden. The major task for the teacher is to facilitate observation by drawing children's attention to various activities on the farm/garden, things seen on a farm/garden, followed by a discussion around it.

Frequent visits maybe necessary to draw children's attention again and again to various aspects of the farm through different seasons. The same farm looks different during different seasons of the year especially so during monsoon, spring time and the dry months of summer. Sudden changes in the weather like strong winds, a storm, unseasonal rains, hail etc., are particularly interesting to children. Observation followed by classroom discussions followed by a thematic activity such as drawing, writing an essay or poetry strengthens the learning process at the same time arousing a desire in children to try their hand at gardening. If the visiting farm permits, children can help with tasks that do not need much skill or experience. An activity like harvesting

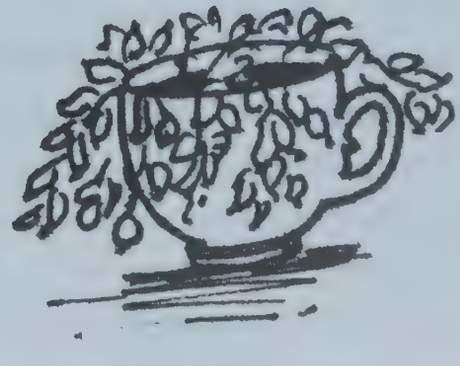
fruits or vegetables is particularly interesting to children.

Visiting a farm in different seasons provides a visual linkage between crops, vegetables and the weather conditions suitable for their growth. This later forms the basis for classification of rabi and kharif crops. A visit to a typical farm provides a rich base for introducing children to the local flora and fauna, systems of irrigation, crop plots and farm beds, trees grown on and around the farm, materials, tools and equipment used in farming etc. Observation of the cow house and animals on the farm further strengthens the linkage between the use of animals in farming and agriculture. Water harvesting, land-water management techniques can also be observed on a farm. Bunds, gulley plugs, water ponds etc., provide linkages between maximizing on available water, raising the water table and land management. Composting areas, the tool shed, the store house provide further insights into farming. The same maybe experienced during visits to a vegetable garden but on a much smaller scale.

When children observe plants in different stages of growth (flower buds, fruits, seeds, saplings etc.), they begin to understand the cyclical nature of plant life. Attention can now be drawn to different types of plants, flowers, fruits and seeds. This assists in drawing linkages between different seeds and the variety of the plant it grows into. An interesting observation would be to draw the attention of children to some local varieties of beans where the seeds (bean) come in a variety of shades of brown, purple, blue and yet all of them grow into a bean plant. On the other hand seeds of chili, tomato, brinjal look similar but yield completely dissimilar fruit. Such exercises help children to sharpen the skill of observation and pattern recognition.

Some questions that can help to stimulate thinking and initiate discussions are:

1. What do you see in the farm/garden?
2. What kind of plants do you see?
3. Are they big or small?
4. What kind of leaves or flower/fruit do you see? Are they same or different in different kinds of plants? What is same or different about them?
5. Do different varieties of plants/trees grow differently (creepers, herbs, bushes, grasses, trees)?
6. Do these look different from the plants or trees you see in an open area?
7. How are these plants sown?
8. Is there a pattern of beds and rows?
9. Who could have planted them this way?
10. Does the soil look different here?
11. What tools are used to prepare the soil?
12. Does soil provide food for the plant?
13. What other role does the soil play?
14. Does the soil need food to feed the plant?
15. Who provides this food to the soil?
16. Do you see small creatures in the soil?



Planting possibilities: cups and mugs

17. What could be their food?
18. Where would their homes be?
19. Do they also provide food to the soil?

Questions such as these could be used to initiate a discussion on how food is grown. The link between soil, water, air, sunlight, weather can thus be drawn.

In the classroom/laboratory simple experiments of germination, observing growth of plants in dry and wet soils, healthy and degraded soil, in shade and sunlight maybe conducted. Observation of germination in different kinds of seed, in monocot and dicot varieties and the fibrous and taproot system can be observed. Experiment to show the (capillary) movement of water from the roots to the stem, leaves and flower can be demonstrated using coloured water. An exercise of sprouting lentils can be undertaken followed by making a simple salad with sprouts and fresh greens, tomato, cucumber etc. This can be linked to the nutritional aspects of sprouts in children's diet. It can also be linked to the various parts of plants that we take as raw foods for e.g., the stem and leaves of coriander, mint; fruit in case of tomato, cucumber; bulb in the case of onion, seed in the case of sprouts etc. This helps in relating to proper scientific terms and later on to exact botanical nomenclature. For young children, observation of patterns in leaves, petals, seed, fruit etc., can act as an introduction to various geometric, regular and irregular shapes. Older children begin to associate these patterns with plant taxonomy. Colour hues and textures of a variety of flowers, leaves, seeds can sensitise children to aesthetics. Knowing the various crops and vegetables in the local language and in other languages helps in language practice and vocabulary development.

Although this holds true for a farm, it can be suitably extrapolated to the existing schoolyard garden or can be a motivation for starting one.

2. Further visits to a garden, starting one for the class or observing older children carrying out key garden operations provide scope for further investigations into the life cycle of plants, classification of plants based on size, lifespan, type of growth, fruiting, flowering patterns, their use in various foods in different ways, linkages to health, nutrition and growth. Students, under supervision, can now take up planting and growing of some short duration easy to grow vegetables in both rabi and kharif seasons. Plant bed preparation is different for different vegetables and varies as per the season. Here students learn various methods of bed preparation. Similarly, sowing methods differ for various vegetables. Here again, students get exposed to different methods of sowing, watering and harvesting. Students can learn skills in estimation, standardisation, measurement, calculating germination percentage etc., while preparing beds, sowing (quantity of seed per bed) and watering. The task of caring for a vegetable bed involves aspects of developing sensitivity, responsibility, reverence for life, respect for labour as well as inculcating a certain work discipline. Looking for weed growth, infestation by pests and dealing with them in appropriate ways builds skills in observation and discernment. Harvest time opens the opportunity for strengthening mathematical skills. Weighing the harvest, calculation of yield per bed, quantitative comparison of seed to harvest, costing, record keeping and documentation provide for a variety of learning

Illustrated summary of Tending a Schoolyard Garden

1. Planting possibilities – old teacups, rubber boots
2. Sari fence to keep away hens as they cannot see through
3. Fence made of locally available dry thorny twigs and bamboo
4. Agave fence protects garden from large stray animals
5. Fence wall made of stones and boulders found during clearing garden space
6. Pond made by stacking old tyres – home to frogs, fish for control of insect and larval populations
7. Compost pit
8. Nursery area for growing fruit, fodder, fuel wood, timber and local tree saplings
9. Drumstick tree high in essential nutrients
10. Bamboo grove area – multipurpose use for poles, pegs, props, creeper pandals, fence, tool-handles etc
11. Concrete fence
12. Shade giving large tamarind tree – ideal for demonstration area, nursery, rest benches, shade loving plants; provides fruit used in cooking. Children relish its tangy taste.
13. Blackboard hangs from a tree branch thus avoiding driving nails into tree
14. Gourds and pumpkins grow on rooftop
15. Sunning of preserves and pickles
16. Vertical garden
17. Differently abled children too can participate in gardening
18. Solar water heater on the roof of school kitchen
19. Bamboo basket lined with plastic for growing gourds that trail over the roof and for growing herbs – handy just outside the school kitchen. Box lined with plastic for herbs.
20. Windowsill herb garden
21. Garbage bins for compostable and non-degradable kitchen waste
22. Green scrub fence – ideal nesting site for birds that feed their chicks on insects and caterpillars

Illustrated summary of Tending a S

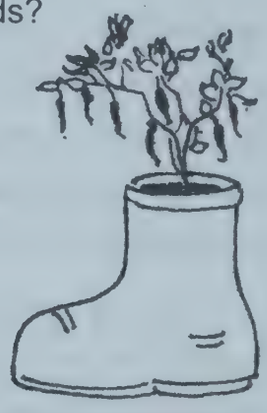
hoolyard Garden

23. Fence with rubble foundation to deter burrowing animals
24. Marigold along garden paths act as natural insect repellent
25. Water loving plants near groundwater recharge pit and low lying areas
26. Tool room showing inside view of shelves and stacking area; tools left outside to dry
27. Weather vane and compass
28. Solar lamp post
29. Panchagavya preparation in progress
30. Bee box
31. Bird bath
32. Planting in east-west direction in the increasing order of size
33. Demonstration area
34. Beds left fallow for soil recuperation
35. Rain gauge
36. Groundwater recharge pit
37. Cemented washing area with a slight gradient
38. Spiral garden – watering at the apex ensures water reaches all plants through the bed channel
39. Keyhole garden for easy increased access
40. Making a garden broom from leftover dry twigs after legume crop harvest
41. Scarecrow with notice board; the bird feeder provides opportunity for children to closely observe visiting birds
42. Boulders – part of the original landscape left undisturbed – used as sitting area
43. CD cover: Fence used for growing bitter gourd. Notice cow displeased with the taste of bitter gourd

experiences. Students learn to work in groups and the value of cooperative team spirit.

Some questions that can encourage investigation and learning are:

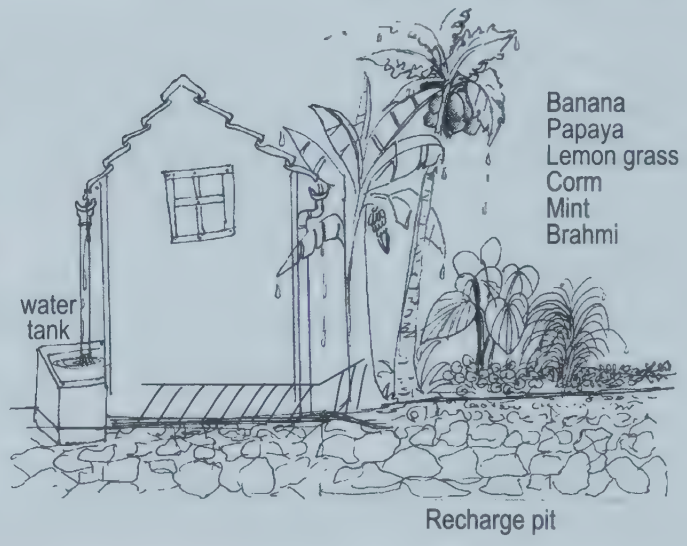
1. How much seed can be sown in a given area?
2. How does one determine the adequate proportion of seed to a bed?
3. What happens in case of seed crowding?
4. How to estimate germination percentage?
5. What is the ideal soil condition for a particular vegetable?
6. How do we determine ideal soil?
7. What is soil pH? Can it be corrected to make the soil appropriate for optimal yield?
8. Does the plant get all its nutrients from the soil?
9. What is the role of water in plant growth?
10. What role does air play in the growth of plants?
11. What is the role of various parts of the plant in relation to its life and growth?
12. What is the role of stomata?
13. What is the role of leaves in a plant?
14. What is transpiration? What is photosynthesis?
15. Why do different plants bear different kinds of leaves, flowers, fruit and seeds?
16. How does water travel up in the plant?
17. How does food/energy travel from the leaves to all the parts of the plant?
18. What is the role of insects, birds, animals in plant growth?
19. What role do creatures in the soil play?
20. How do we tell a healthy plant from a sick one?
21. What causes illness in plants?
22. Can we keep plants healthy and growing well? How?
23. Can we cure plants of illness? How?
24. How do we select good seeds and preserve them for growing plants?
25. How does a flower become a fruit with seeds? What is pollination? What is fertilization?
26. Does the fruit have a role to play in the life of a seed?
27. What is mixed cropping?
28. Why must plants be planted such that the short ones are towards the east and tall towards the west?
29. How are different vegetables harvested?
30. What can we do with excess produce?
31. How can we keep them for later use?
32. What are the different ways of processing different crops: legumes, millets, paddy, oil seeds?
33. What else can plants give us other than food?
34. Investigating the various uses of plants such as for – timber, cloth, fodder, medicine, personal care, aesthetics, as regulators of micro climate etc.



Planting possibilities: old rain boots

35. Are all animal citizens in the garden friends of the garden? Can some harm the garden, how? What can be done to prevent it ? How?
36. How are the tools used in the garden?
37. How are gardening tools made? What is the scientific principle behind the functioning of each of these tools?
38. Are the water needs of different vegetable plants and trees different? Why?
39. When do we see different animal visitors in the garden? What role do they play in the garden?
40. How do large farms water their crops?
41. What are the different methods of irrigation?
42. Do all crops and vegetables need watering every day? What are the various patterns/ frequency/ time gap for watering?
43. What role do animals play in large farms? How do cows, bullocks, sheep, hens help in farming?
44. What are food webs and nutrient cycles?

Such enquiry and investigation can lead to many small assignments that students can take up individually or as a team. This can be further linked to various academic topics for e.g., soil pH can be linked to the study of acids and bases; the acidic and basic nature of substances in nature; making of natural pH indicators from turmeric in the school kitchen or from flowers in the garden. Mathematical operations of ratio (seed:land:produce) and proportion, area and volume (consumption of water, soil inputs), percentage, profit and loss, statistics, graphical representation, rows and columns (HCF and LCM), shapes etc., can be linked to garden work.



Rainwater harvesting tank and recharge pit near kitchen and washing areas.

Working in the garden draws out the link of academic knowledge to its practical application for example measuring the depth of water in the well in different seasons links geography to mathematics and its relevance to farming; calculating the area of the garden, deciding on plot sizes, measuring and marking the plots, designing the garden layout based on slope of land and direction of sunlight, creating a planting calendar and deciding on crops to be grown, qualitative and quantitative measurements of harvests integrate academic knowledge in science, mathematics, geography, language etc. Teachers have observed that such practical applications strengthen and provide permanence to academic learning.

3. After an experience of several cycles in growing vegetables, students can proceed to plan the sowing of grain crops if space, infrastructure and funds permit. If not, it can be explored in small experimental beds in the school garden itself. Seasonal plans can be made for crop rotation, intercropping and mixed cropping. This planning will be based on discussion on past experience in

gardening, best practices, good yields, successful harvests etc. Detailed study of garden design for water use maximization, water harvesting practices, planning for maximum usage of sunlight, and using both horizontal and vertical space can be experimented with. Companion cropping and techniques of permaculture design can be explored. Vertical gardens, square foot gardens, aquaponics etc., are interesting variations that teams can experiment with. Maintaining a systematic garden journal is now essential and could be made mandatory.

Some practices to adopt, skills to learn at this stage are:

1. Keeping a garden journal to record plot size, weather and temperature record, type of crop, soil nutrients added, watering and weeding schedule, nature of pest attacks, treatment schedule for pest attack. Details of pests, intensity of attack, flowering time and duration, fruiting and seeding time and duration, harvest (yield, number of harvests from a given plot, date and quantity).
2. Preparation of compost
3. Preparation of soil inputs
4. Preparation of soil nutrient formulations
5. Preparation of broad spectrum pest repellant
6. Preparation of broad spectrum growth promoters
7. Integrated pest management techniques
8. Role of farm animals in farming
9. Basics of mycology; its role in soil health
10. Life cycle of the earthworm, it role in soil health
11. Science of fermentation
12. Water cycle in nature
13. Hydrogen cycle in nature
14. Carbon cycle in nature
15. Nitrogen cycle in nature
16. Oxygen cycle in nature
17. Role of weather in farming, its linkages to various stages of farming and plant growth. Traditional methods of weather prediction
18. Traditional methods of seed keeping and propagation
19. Traditional knowledge of farming techniques
20. Traditional tools
21. Maintenance and repair of simple tools
22. Visit to a tool workshop – basics of tool making and metallurgy
23. The schoolyard garden as an ecosystem

4. Students can now experiment with creating a complete self-sufficient food garden using a combination of best practices from various methods of farming such as natural farming, ecological farming, permaculture, bio-dynamic farming etc. The garden can include cereals,

millets, pulses, oil seeds, vegetables, greens, medicinal plants, herbs, corms and tubers, gourds and beans, fruit bearing trees, fibre plants, timber, fodder and green mulch plants, hedges of broad spectrum pest repellant bushes, etc. The aim is to reach a complete self-regulating, self-sufficient farm ecosystem model as far as possible. If this is limited by space and infrastructure constraints, certain aspects of the whole can be explored in a project mode based on interest and skill.

Growing a plant nursery, horticultural techniques of grafting, cross pollination for developing hybrids, mushroom cultivation, bee keeping can be attempted.

Experience in animal care and ethno-botany and ethno-veterinary practices can be also taken up. Learning about common home remedies, preparation of personal care products such as tooth powders, herbal soaps, scrubs and creams can be undertaken. Students can learn to grow a nursery, transplant saplings; grow fruit, timber, fuel wood and fodder trees.

Techniques of food preservation, value addition to farm produce such as making of potato chips, chutney, pickles, squashes, multigrain porridge mix etc. are other areas for exploration.

5. Students can now be encouraged to deliberate on the larger issues related to farming, the ways in which it is be being impacted by human interventions such as: use of chemical fertilisers and pesticides, corporate hold on seed production; bank loans and subsidies for farmers and its negative repercussions; farmer suicides; industrialisation, globalisation and out migration to cities; influence of media and technology on farming and village economy as also on dietary habits, health, lifestyle related disease; external cultural influences on village communities; construction of big dams and its impact on people and environment, role of big dams in changing agricultural patterns; introduction of genetically modified seeds; factory style farming practices, mono-cropping; pollution of air, water and land; political and governance related issues to farming; carbon footprint, carbon sequestration etc.

The natural phenomena that can be explored are climate change, global warming, unpredictable weather patterns, impact on ecology and environment, deforestation, phenological patterns in local flora and fauna etc. Understanding the concepts of sustainability, equity, justice, food miles, energy descent, renewable sources of energy, maximizing on solar power, fast growing fuel wood species; making charcoal, solar cookers, solar dryers, etc., can be more areas of interest to students. Study of agro-climatic regions, agro-geographic region and agro-ecological region can also be of interest at this stage.

The ultimate aim is to prepare students to work towards self-sufficiency, strengthening community life, creating a life style that is based on sound ecological principles, living a life of low energy needs, localisation of the economy, non-violence, and, self regulation within democratic governance.

II. Cooking, Food and Nutrition

Technological progress, globalisation and economic factors have increased our alienation from locally grown foods. As a result, we as a society are turning towards unhealthy readymade food options. Traditional cuisines are slowly disappearing and with it the raw ingredients that earlier went into cooking a wholesome meal. The issue is also fraught with gender concerns since the activity is seen as something that girl children must surely know about, especially at home. A greater irony exists in patriarchal societies where despite cooking food, women and girl children are mostly deprived of good nutrition. Globalisation and economic considerations have led many farmers to grow extensive monoculture cash crops using hybrid seed varieties, irrigation, chemical fertilisers and pesticides. This has had an adverse effect on the environment as well as on the physical and cultural health of society.

Cooking is one of the most ancient of human activity. It distinguishes us from other living organisms and is unique to human beings. Cooking (processing) raw food has allowed humans to eat foods that would have otherwise been indigestible. Cooking is linked to wholesome nutrition, health and wellbeing in a fundamental way.

The family kitchen comes closest to a chemistry laboratory since many cooking procedures involve chemical reactions that occur due to application of heat. Biochemical processes take place during fermentation, marination, hydration, germination (sprouting), dehydration etc. Cooking involves the understanding of physical and biological reactions as well as mathematical application of estimation and standard and non-standard measurements. It creates an opportunity to understand the linkages between food, nutrition, health and wellbeing as also the larger issues of socio-cultural-economic-political significance.

Teacher preparation, careful planning of activity and demonstration by the teacher during koshimbir preparaion by children of class 1

A critical understanding of food opens up the dialogue for an in-depth analysis of the society and its functioning. A kitchen and the activity of cooking is a rich source of many kinds of learning. By virtue of being a regular routine activity it draws attention to the cyclical nature of life processes. The schoolyard garden can be easily linked to the school kitchen and *the mid-day meal scheme* thus providing wide scope for an integrated pedagogic approach to academic topics. It widens the scope for including nutritionally rich supplements in the diets of growing children and fostering healthy dietary habits from a young age.

Young children pealing cucumber for preparing a green salad. Improves eye-hand coordination, builds concentration required for careful tool handling

(I) Some notes on pedagogy

1.Very young children can be exposed to methods of food preparation which do not involve cooking directly over a heat source such as gas, electricity or a wood stove. Instead, they should try out simple recipes that involve cutting, mixing, grating etc. They can set curd, make buttermilk, sherbet, *chewda,* puffed rice chaat; sprout, vegetable or fruit salad etc. Teachers can demonstrate cooking to draw their attention to the different processes and the sequence involved in preparing a particular dish. This naturally facilitates vocabulary and language building as children speak and write about their experiences in the kitchen. They are also exposed to the basics of non-standard and standard measurements in terms of weight, size, volume and proportion. The activity also builds fine and gross motor skills as they wash, cut, stir, mix, draw (document), grate, pour, swish, toss, peal etc.

2. Students in the age group of 8 to 9 years have better control over their body movement; hence can be involved in activities requiring higher skills of coordination. At this stage children can be involved in the preparation of vegetable dishes, simple breakfast and snacking items under teacher guidance and supervision. The teacher needs to plan systematically in order to ensure that all children get to experience the multiple skills involved in cooking. This can be done by allotting a different task each time to individual children (or the group). The importance of organised operations needs to be brought to children's attention such that they are able to appreciate its relevance. For example, if vegetable *khichadi* is being cooked, then, a group of children can do preparatory setting of space like taking all the required material, vessels/containers, plates, knives etc.; ensuring that all things are clean if not, cleaning them again. Newspapers can be spread on the floor before chopping vegetables so that cleaning is easier. Other groups can be involved in weighing materials, washing vegetables and grains etc. Handling different vegetables involves multiple skills which the teacher should monitor carefully. At this stage, the actual cooking should be done by teachers while children observe the process carefully. The teacher can sensitise children to ways in which different ingredients are added, their relative proportions and absolute quantities through estimation as well as standard measurement. This would help students gain a good understanding of quantification as well as the logic behind it. This experience serves as a good link between food and nutrition, in terms of sources of proteins, carbohydrates, fats and fibre. This can further be linked to how different nutrients are needed by the body for a healthy metabolism. Teachers can also use these sessions to sensitise children to the effort that goes into cooking a wholesome meal; draw their attention towards the need to respect the food being served rather

than be fussy about eating. It also inculcates a culture of eating together, taking responsibility for cleaning the kitchen area and practice in working together. These activities become a starting point to initiate a dis-cussion on gender relationships and the norms in society on such matters. In particular, children can be encouraged to ensure that female members in their own family have adequate nutritious food rather than consume leftovers as it often happens in Indian homes. Broadly, many aspects of gender equity can be brought in through related discussions.

Planning and organising is the key to successful kitchen operations. Students chopping okra for cooking

It is a good time to now begin understanding the science behind various ways of cooking such as baking, boiling, frying, steaming etc. They can also be encouraged to discuss and observe proper ways of cleaning and cooking various food items such that there is minimal loss in nutritional value.

3. By this stage, pupils can participate in various activities requiring higher skills as well as depth in inquiry. For example, learning about specific nutrients present in various fruits and vegetables, the chemical reactions involved in different methods of cooking such as fermentation, steaming, boiling, frying, dehydration etc. They can also be encouraged to make a note of various energy resources required for cooking; drawing distinctions between conventional and non-conventional sources of energy. Use of solar cookers and *sarai* cooker can be demonstrated. The use of a right combination of various cooking appliances should be encouraged and brought to the notice of students such that students appreciate the value of cooking with minimal energy utilisation. The use of biogas as against the use of the conventional *chulha*; the resultant pollution and health hazards form interesting topics for in-depth investigation. Senior students can make hay boxes, solar dehydrators, charcoal, build a wood fired oven etc. The need for maintaining cleanliness and orderliness during cooking should be emphasised over and over so as to become second nature.

Weighing of all ingredients as per recipe prior to cooking

Students can be exposed through discussion, news reports, documentaries etc., to the larger social dimension of food and nutrition; the nutritional needs of the female body in particular and its relation to child mortality and maternal health; limited food

diversity in routine diets; and the effect of media in influencing food choices. Students can be encouraged to learn local and traditional cuisines; gain some understanding of how cultural traditions, regional history and geo-climatic factors influence food habits. This brings to the fore the question of food miles, environmental impacts, self-reliance, economics of crop production as well as the right to food, especially, for the very poor in this country. Equally important is the issue of growing and consuming safe organic food, its relevance to human and ecological health; the nature of adulterants in food and ways to ensure that we consume safe, wholesome, healthful meals.

(ii) Easy recipes for the school kitchen

Recipes of some uncooked food items for young children:

1. Green sprouts salad

Ingredients: mixed sprouts, tomato, cucumber, onion, chili, curd and lemon juice (optional), radish, carrot, beetroot, lettuce (if grown in the school garden); grapes, green mango and pomegranate (if in season), mint, coriander leaves, peanuts (whole, half or coarsely powdered), salt to taste (optional).

Skills and vocabulary: sprouting, fermenting, cleaning, washing, cutting, breaking, chopping, crushing, squeezing, mixing, shredding, serving, sharing, eating.

2. Fruit salad

Ingredients: common fruits available year round – banana, papaya, sapota.

Seasonal fruit – sweet lime, orange, apple, cherry, strawberry, mulberry, pears, figs, grapes, mango.

Seasonings/toppings: lemon, honey, jaggery, salt, sugar (optional)

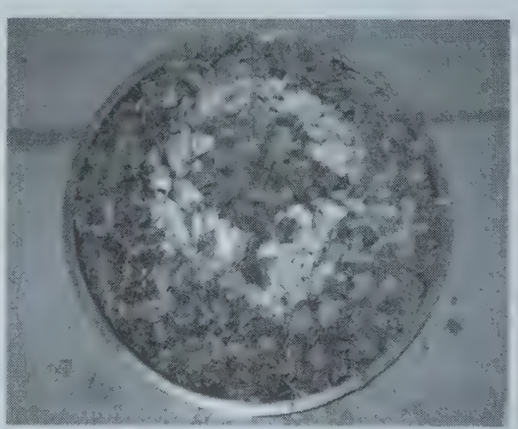
Skills and vocabulary: picking, cleaning, washing, cutting, chopping, shredding, mixing, serving, sharing, eating.

3. Lemon sherbet

Ingredients: lemons, water, salt, sugar/jaggery.

Skills and vocabulary: selecting, washing, slicing, squeezing, crushing, mixing, adding, stirring, straining, pouring, serving, sharing, drinking.

Teacher demonstration: uncooked bhel puri with sprouts and greens



Green salad by class1

Head teacher helping and showing the correct way of washing big utencils

4. Buttermilk drink

Diluted well whisked curd, crushed ginger, coriander, cumin powder, rock salt, pepper and/or green chili (optional).

Skills and vocabulary: cleaning, washing, squeezing, mixing, crushing, cutting, serving, sharing, drinking.

A few food items requiring some cooking/processing that can be prepared by older children:

Fermentation: curd, idli, dhokla,

Drying: amla supari, potato chips

Baking: biscuits

Cooking: khichadi, kheer, cooked vegetable dish

Frying: paneer pakoda (paneer/cottage cheese to be made by children)

Easy to cook simple snacks: bhel puri, chivada, poha, upama.

Roasting: peanuts, pumpkin seeds etc

Grinding: chutney

Pounding: dry chutney

Preservation: jams, pickles, fruit preserves, sauces, ketchups

At Anand Niketan cooking is linked to growing food (gardening and nutrition) in the following ways:

- Vegetables grown in the kitchen garden by the students are used in cooking
- Nutritional aspect of the nutrients present in each ingredient used for making a particular dish and role of that nutrient in growth and metabolism is discussed and explained.
- There is a conscious effort to make cooking a team activity with emphasis on coordination of group members and distribution of responsibility for particular tasks.
- The recipes to be cooked are decided keeping in view special occasions and local festivals like Raksha Bandhan, Independence Day , Pola , Deepavali etc. Special dishes which are traditionally cooked are linked with its relevance to the event as well as the season.

Teacher demonstration: cooking with fuel efficient charcoal sarai cooker

Washing greens throughly before use

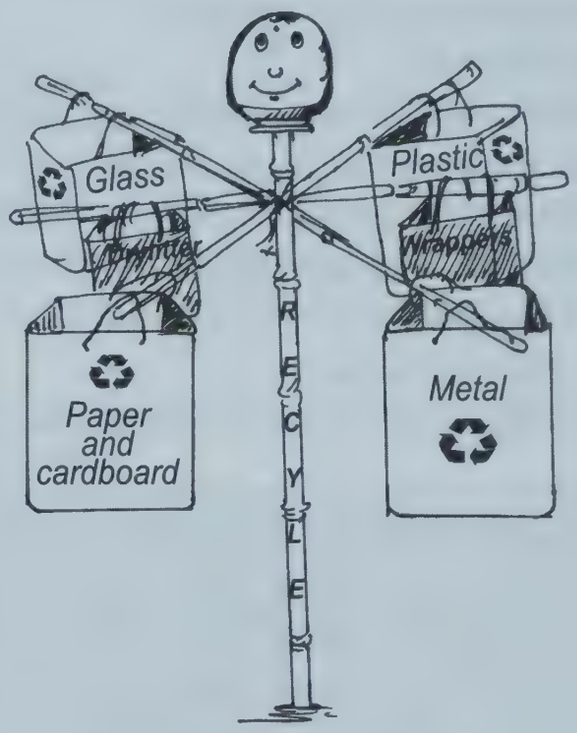
Organising a washing area for used utencils

III. Understanding Waste Creation and its Management

Both degradable and non-degradable wastes are a major civic menace and health hazard in this country. They are a direct reflection of our irresponsible behaviour and indifference to civic sensibilities. Except for very remote human habitations where very little waste is generated, every lane, road, town, city and wayside open space is strewn with non-degradable litter and garbage. Hence it is very essential that we are alert to this issue and mindful about how we deal with it.

It is essential that children learn responsible behaviour with regards to waste and cultivate the discipline of generating very minimum of non-degradable waste as well as the discipline of making such waste available for further recycling and reuse.

Children should learn to dispose organic and degradable waste such that it is composted to enhance soil nutrient content to feed into the food chain. These lessons should be learnt from an early age at home, in the neighbourhood and at school. Linking the kitchen and the garden waste of the school to the school garden's composting unit is probably the most primary lesson one can learn at school. The introduction to correct handling and disposal of organic waste can be learnt from nature – a forest ecosystem – which is the most efficient recycler on this planet.



Placing recycle bins in the school premises in selected locations helps children to inculcate the habit of sorting waste from an early age, making it part of school routine.

(i) Some notes on pedagogy

Shivramanji teaching children to make science models from non-dregradable waste plastic.

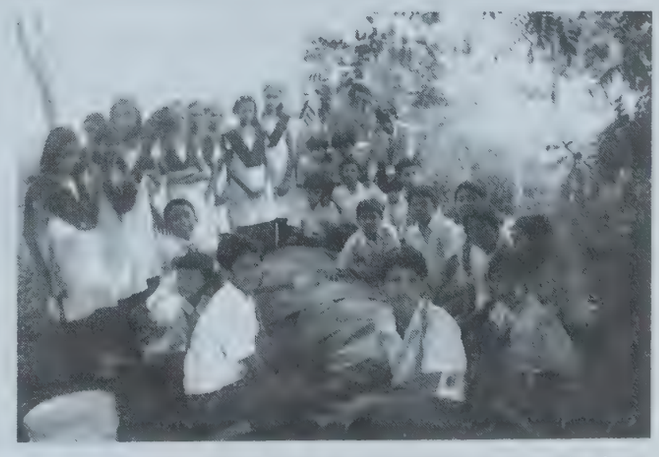
1.Children can begin with the exploration of the school campus to observe and distinguish between biological (organic), and, non-biological (inorganic or non biodegradable) waste, and unused, discarded, abandoned articles. Their attention should be drawn to the natural composting process of plant and animal parts in nature. This is easily observed under a tree or under a patch of green cover in the school campus or in an open space in the vicinity. They can then proceed towards collection and segregation of biological

Dinkar Vidya Mandir students gleefully mix cowdung and water for the biodung compost

waste. A good activity for children are the numerous art, craft, useful articles including learning materials one can create with degradable and non-degradable waste. These are very vital lessons for children in recycling, reuse and thrift. Repeatedly it should be brought to the notice of children that many things that one considers as waste can actually be reused in very many creative ways.

Children learn best from example. Teachers and adults should practice reduction of dependence on/use of non-degradable material, and where inevitable one must consciously strive to keep its use to the minimum. Finding the half life of a variety of biodegradable and non-biodegradable materials can be illustrated through a simple time-lapse experiment by burying various materials underground followed by their examination at periodic Intervals of time. Children can instantly see the connect to the litter and garbage around and why improperly disposed waste, litter and garbage are such a huge menace and hazard to society.

2. An enquiry into how organic waste is converted into useful soil nutrient/compost/humus can be undertaken through building a close association with the composting area of the schoolyard garden. A comparative study of samples of the organic waste at various stages of the composting process will give children an idea of how this biological process takes place in nature. Observation of a sample of stagnant water from a nearby pond or a suspension of immature compost will be an exciting experience and a magical revelation for children. Children will be most happy to look for the little creatures in the soil if given magnifying glasses (accompanied by strict precautionary handling instructions). This study can be fascinating and can keep children engaged for long durations over a long period of time. Children can learn to identify the features of mature compost, learn the application of ready compost to plants and to vegetable beds; a discussion on the need of its use can be initiated. If different methods of composting are underway in the school garden or on a farm in the neighbourhood children can observe different methods such as heap, pit and vermicompost, a biogas unit etc. If visiting a biogas unit, the composting process as a source of fuel (biogas) can be further linked to the topic of energy needs, renewable energy and appropriate technology.



Dinkar Vidya Mandir students pose at the just prepared biodung compost heap covered with plastic

3. After understanding the process of waste generation as being a byproduct of human activity and its constructive use in the production of compost, students should themselves undertake the activity of

composting. Being a live, dynamic, biological process, each step involves exposure and linkages to the various academic topics within science, geography and mathematics. Students can explore composting under both aerobic and anaerobic conditions, the latter occurring in moisture saturated circumstances. Students can also experiment with different methods of composting of garden and kitchen waste separately. The monsoons come with their own set of challenges to the composting process. These too can be a good opportunity for study. Different season and time of the year brings with it its unique array of sub-soil, terrestrial and aquatic flora and fauna. These too can be linked to the growing and composting processes in the schoolyard garden.

4. On an average the standard composting process with biodung takes 2 to 3 months depending on various parameters of biomass, temperature, humidity, moisture etc. Various techniques of composting are ideal for various seasons and weather conditions. These techniques can be explored. The use and role of cow-dung in the formation of compost using the heap method opens the opportunity for learning aspects of microbiology and biochemistry. However, at this stage, it is more important that children master the skill of successful composting rather than worry too much about the science behind it. Turning the compost periodically every 2 weeks in the pit method and every month in the heap method; observing, feeling and measuring its temperature and keeping diligent record of these observations, including visible floral and faunal activity helps to perfect the art of composting through several repetitive cycles. One learns from successes and failures. Students can learn in a systematic manner the effect of various parameters such as site, proximity to water, effect of sun or shade, air, water, sunlight, type of biomass, types of inoculants etc.

Some of the specific steps involved in composting are:

1. Selection of site for composting
2. Collection of biomass and biodung
3. Preparation of cow-dung slurry
4. Step by step preparation of compost heap
5. Layering/covering with soil
6. Periodic observation and record keeping of mass, colour, volume, odour, temperature, moisture content, floral and faunal activities
7. Similar observations as above during turning of compost, and of mature compost.
8. Sieving and application of compost
9. Appropriate storage.

Managing our waste correctly and putting nutrients back into the cycle of life offers invaluable lessons in taking good care of the Earth – our home.

(ii) Recess time: *humanure*

Since schools have at least a hundred, if not more, children spending the larger part of the day in its premises, adequate urinal and latrine provisions within the campus are mandatory. Introducing the topic of toilet training, etiquette, hygiene is a routine task for the teacher. However,

what really happens to all the human waste within the school as also in homes and public places is rarely discussed. The topic is also fraught with socio-cultural taboos that a teacher is required to handle with tact. This can be quite a challenge as there are a few hundred female and male children on the premises, each requiring to use the facility a few times a day. The attitudes they develop collectively depends much on the attitude adopted by the school's teaching and non teaching staff.

The proper disposal and processing of human waste can be easily introduced through the schoolyard garden which is already linked to the school kitchen and the school composting pit. A discussion on the topic can begin with some questions listed below and a few suggested experiments and projects can be taken up by students based on maturation and skill.

1. Why do we wait for the recess bell?
2. Where do most of us head during the recess break, why?
3. Do you see animals taking recess breaks? Have you observed them carefully?
4. Do they display any peculiar habits?
5. Do humans display any peculiar habits? Need for privacy/seclusion?
6. Concerns related to hygiene? Why is it necessary? Its relation to parasitic and communicable diseases.
7. What happens to human urine and excreta?
8. Why are toilets located away from the main classroom area?
9. Why do they emanate a peculiar odour?
10. What is the physical and chemical nature of human urine and excreta?
11. Do its contents have any value that can be reclaimed as nutrients for the soil?
12. Can human waste be recycled? What precautions have to be considered?
13. Conduct a study of the toilet use/habits of the neighbourhood?
14. What does this study reveal? Which are the types of toilets in use in our neighbourhood?
15. What happens when we flush the toilet?
16. Let us follow the sewage pipe all the way to its destination and see what we can learn along the way.
17. Kinds of composting toilets. Field visit to study various working models in the neighbourhood.
18. What is humanure?
19. Setting up a model compost toilet in the school compound. Can it be done? Shall we do it?
20. The deep pit toilet and the dry toilet.

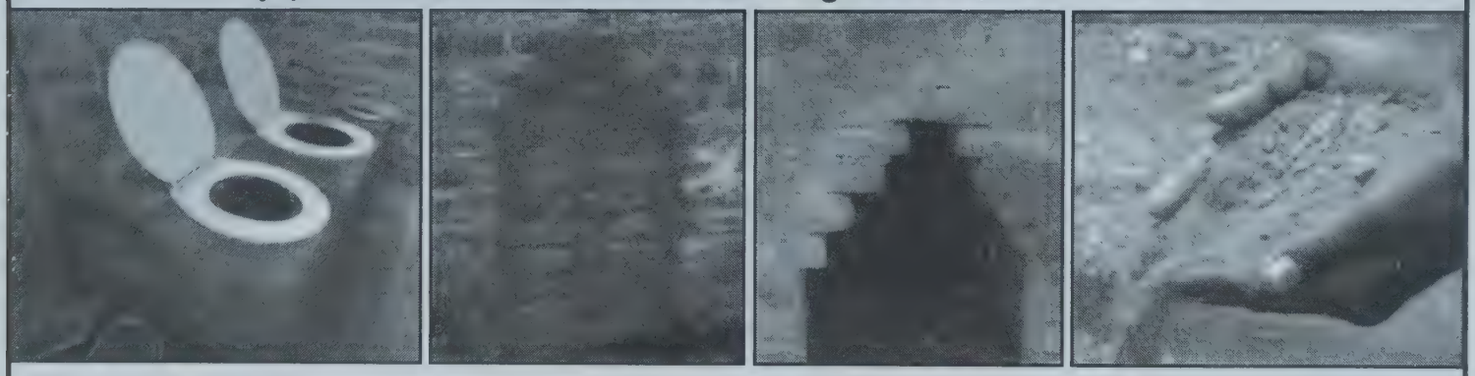
Maintenance of sewage pipeline: senior students work with head teacher

21. Where can we use the humanure? As manure for timber, fuel wood, fodder and biomass trees. Experiments related to its use.
22. Planting deep rooted trees around composting toilets, for absorption of leeched nutrients.
23. Study of such plantations for its growth and phenological aspects.
24. Why must toilets be kept clean?
25. Who is incharge of keeping them clean in your home, school, neighbourhood and at public facilities
26. Learning the right way to keep a toilet clean and its regular maintenance.

As an experimental study model, a school with some open space to spare can easily undertake the construction of a temporary deep pit dry toilet, at least for the use of senior students or staff. The use of paddy husk, kitchen ash, mud, saw dust can be used for layering after use. Closing the pit when full and reopening after six months will yield good quality humanure. If the experiment is a success the school may wish to build some more. The manure can be tested by senior students for its nutrient quality. Its pathogen content can be tested at a local laboratory. Planting deep rooted trees around such facilities will maximise the use of leeched nutrients.

There exists discomfort in openly discussing human waste and its appropriate disposal. Its use as valuable manure does not find ready acceptance. The schoolyard garden can be linked to this topic through linkages with the garden yield that is cooked/consumed and the resultant waste generated by the human body. Even if it is not possible to build a composting toilet, a detailed study of the topic will assist in creating the right approach and attitudes in children towards humanure. The topic establishes the cyclical nature of energy transfer in a very direct way by linking it to our daily life at a personal level.

Dry pit toilet at Puvidham Learning Centre, Tamil Nadu



The top chamber has two users for small children. (Can be made for one user).The holes are made in cudappah stone and then fitted with the toilet seats. Urination and washing is also done in the same place. In our dry climate it works. The lower collection chamber can be opened and we can collect the manure after 6 months. After use the night soil is covered with ample soil. The toilet seat is swept with a coconut fibre brush and kept clean with old cloth which is regularly washed. We don't use toilet paper because of our concern for trees.

– Meenakshi Umesh

IV Lessons from a Hailstorm

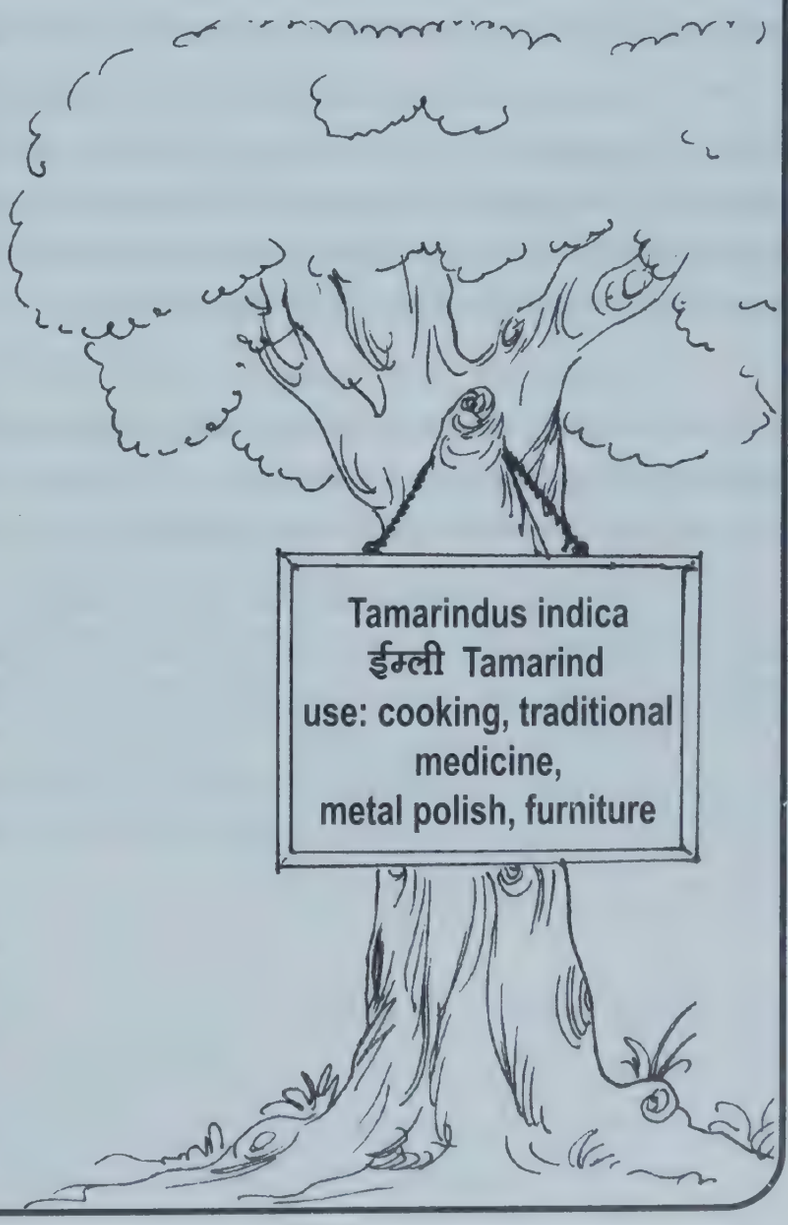
(an extract from teacher diary notes)

Class III, Anand Niketan

27th February 2014

In the evening there was thunder, lightning and a hailstorm. The following day, when students came to school they were very eager to share their experience of witnessing such an intense hailstorm. They could see hailstones falling in the courtyard of their homes; they took it in their hand and played with it. They also experienced the problems such hail brought. The seepage of water from the roof did not allow people to sleep; trees had fallen on the roads making access difficult and causing people to make detours. The crops of wheat and chickpea on the farm was completely destroyed, the plants lay horizontal on the ground.

The children decided to make a tour of the school campus to assess the situation. They were immediately attracted to the tamarind pods that had dropped under the huge tree in the school campus. Students went to collect the tamarind fruits. They collected the fruits in baskets, each student measured the quantity of fruit she/he collected with the help of a spring balance, then they added the quantity of tamarind collected by each student and calculated the total quantity of tamarind collected by all students. The total quantity of tamarind was converted from grams to kg. (1000 gm = 1kg). They decided to sell the tamarind; deciding on a price for collecting the fruit at Rs.7 per kg. This way learned about costing a service. Totally about 2 kg and 200 gm. of tamarind pods were collected. It was to be equally divided among 11 students; through this they learned the use of division. They also learned about the use of tamarind fruit in their daily food, its nutrient value, taste, quantity (minimum/ little) used in cooking.



Students were asked to write a one page note on their experience of collecting tamarind and give a title to their essay. The essay was than corrected by the teacher and corrections were discussed on the blackboard.

The collection of tamarind was creatively used to touch on several academic topics. An unusual natural event was used to link academic topics in a natural way based on what attracted the children the most – tamarind collection.

3. Essays for Teacher Orientation

I. Children of Nature

The underlying principle that must guide our actions today is the connectedness of human life and activity to other humans and all of nature. Nowhere can this understanding be more emphasised than in the education of our children. To live in attunement with the sensibility that we are really the *Children of Nature,* we must first seek to understand what it means to be so.

As a dominant species, endowed with highly superior intelligence and an almost infinite capacity to alter and manipulate our physical and natural environments, we carry the responsibility of caring for the *community of beings* including the beneficent elements of this planet.

The *living systems* and the *living universe world views* that instinctively made Indians and the people of other ancient cultures respect and venerate nature is slowly regaining its rightful place in global consciousness. In recognition of the need to conduct our lives grounded firmly in planetary level ecological moorings, the current times is being rightly referred to by many as the *Ecozoic Era.*

How does one begin to place this before children in ways that they can appreciate? What can we, as teachers, do to realign our own sensibilities such that the underlying principles are reflected in our daily life? For any effective awakening/sensitising within children there is a need to first begin with ourselves. Being role models, setting an example, working alongside, doing and learning together may yield some desirable results.

Working with living systems offers ample opportunity to understand our connectedness with nature. Living systems respond in living ways that are easy for children to discern. For instance, plants if tended with care thrive, bloom and yield. On the other hand, if neglected or dealt with in inappropriate ways wilt, dwarf or ultimately die.

Tending a garden seems an ideal activity for establishing our connectedness with nature. As active participants in the tending process teachers and children together can discern first-hand the cyclical nature of all processes and the connectedness of all beings on the planet and beyond.

As an ancient Cree saying goes, *'All things (beings) are connected, what befalls the earth, befalls the children of the earth.'* A wake up call such as this, to let go unheeded would be to our peril.

II. Getting Our *Fundas* Right

It is becoming increasingly clear that the entire *community of beings* including the beneficent elements, generally referred to as *nature,* are interlinked through a web of life. In the natural world these interlinkages display a cyclical pattern. This cycle comprises of birth, growth, reproduction, decay (death) and regrowth. In many ways, physical, chemical, technical, material and 'non-living' systems are easier to comprehend than the interconnected, interdependent networks and webs of 'living' systems. However advanced human society may grow technologically, if it has to survive, it will have to conform to the cyclical nature of life. At this juncture, when life on earth is precariously hinged on the course of action humans decide to follow, it becomes necessary to understand and stay true to the laws laid down by natural systems.

Life is sustained in living networks wherein nutrients (energy) are passed around in cycles. In ecological terms, these are referred to as food chains. Such food chains are interlinked in food webs. There exist numerous micro-organisms within soils where they carry on the work of recomposing organic waste into potential nutrition. Plants grow because of this nutrient content that is made available to them in absorbable form in the soil. Animals (primary consumers) sustain themselves by consuming these plants. For life on this planet the Sun is the primary source of all energy and plants are the primary producers of all nutrition. Water, air and minerals (the earth-base) and weather conditions play their respective roles in the production of nutrition/food by primary producers. Plant and animal life is sustained on a law of return which they abide by through decay (death) and excretion, thus making provision for soil micro-organisms to do their work of recomposing the 'waste' into absorbable form for plant nutrition.

The most significant contribution for sustaining all life on earth is that of the numerous creatures that live in the soil. Picking up from there is the world of plants. This particular bounty of creation has been endowed with the magical boon of creating food for all out of thin air, literally! In a food garden we witness this magic. The roots of plants take in water and mineral salts from the soil and the resulting liquids rise all the way up to the very tips of each and every leaf. In the leaf they combine with the carbon dioxide from the air to form sugars and other compounds. In this mysterious magical process, known as photosynthesis, the sun's energy is converted into chemical energy and bound within the resultant substances while oxygen is released into the air by way of transpiration to be taken up by animals (and plants and microbes) through the process of respiration. By blending the water and minerals from below with the sunlight and the carbon dioxide from the atmosphere, green plants link the earth and the sky.

Most of us assume plants grow by taking in enormous quantities of nutrients from the soil, but the fact of the matter is that, the bulk of the plant body (cellulose) and other complex compounds produced through photosynthesis consists of material that is rich in carbon, hydrogen and oxygen (organic compounds) which plants take from the air in the form of carbon dioxide and moisture.

Wherever we see life, we see networks and wherever we see living network, we see cycles. The basic phenomena one observes is the web of life, the flow of energy, the cycles of nature. These can be experienced, explored and clearly understood by children through activities such as gardening, cooking, recycling of organic waste.

In a garden, children begin with soil and seed and the garden cycle ends with producing seeds which begin the cycle of life all over again. Similarly, cooking is an example of repetitive work. It is something we do over and over again. It leaves no lasting traces. We cook a meal, eat it, clean the dishes and put them away. Very soon we again use the dishes to restart the cycle again. In both gardening and cooking there is some amount of unused material left behind which we call waste. In nature there is no waste. Everything is a part of the continuous cycle of birth, growth, decay and regrowth. Since both gardening and cooking are human activities undertaken in artificial (man made) environments, some amount of waste is generated. This so called waste is only partly used/unused organic matter that is waiting to be recomposed into nutrients for plant growth. In this re-composition, we understand the vital role played by soil micro-organisms in putting things back in their proper place. This re-composing process is most critical to sustaining all life which is really a network of feeding relationships or energy flows – the basic ecological principle.

Through hands-on gardening, cooking and recomposing waste into useful nutrients children can understand real life processes. The greatest challenge we face today is to create a human community that understands this living system process. If life on earth has to stabilise and continue, humans will have to learn to create ecologically sustainable communities, communities that satisfy their own needs and aspirations without diminishing the chances of future generations to satisfy their own needs and aspirations.

Waste management and soil fertility

In nature, the cycle of recomposing plant and animal waste into nutrition is a continuous process that goes on, mostly unnoticed, in the soil on land and at the bottom of water bodies, rivers, seas and oceans. This critical role of re-composition is played by very small creatures both visible and invisible. These are broadly referred to as micro and macro subsoil flora and fauna. For our purpose, we will look more closely at the re-composition process in the soil on land. The abundance of nutrients in the soil is referred to as soil fertility or soil health. In the natural cycle, what goes back to the soil is re-composed by soil microbes at suitable temperature and moisture in the presence or absence of air into absorbable nutrients.

In a man made system, such as when we grow plants (for food, clothing, timber etc) or cook it, we generate certain amount of 'waste' which is so because it is misplaced or in the wrong place. This should be rightly going back into being converted into nutrients. We call this process composting. In our need to grow plants in 'created environments' for our use, we need to ensure two important conditions are maintained. (1) To return back to the soil in a useful form (nutrient) all that we leave unused (organic matter) including waste created by plants and animals (including

humans) in the process of living (especially animal excreta, leaf litter, dead-wood, remains of dead animals). (2) Ensure that the life of micro and macro organisms within the soil exists and proliferates such that they can carry on their work of re-composing i.e., we sustain the life within soils for it is they who are the real life givers. They have to be sustained because one cannot sustain life by killing life givers.

Human activity is not only generating waste that can be converted back to nutrients (what is called organic or biodegradable waste) but also that which cannot be converted into nutrients (what is called non-biodegradable waste). Examples of this waste can be seen all around us! The processing of this waste to some usable form is referred to as recycling. (*It must be understood that with the re-cycling of organic waste, we also have the responsibility of reducing non-recyclable waste).* All of this is created using raw materials that have their origin in nature. This is known as resource, and nature has it only in finite quantities.

Historically civilizations have collapsed or have been wiped out because of the inability of humans to maintain the fertility of the soil or because they used materials from nature to such an extent that it was taken out permanently or taken out faster than it could be put back. Hence it is necessary to understand the balance and cycles in nature both living and physical because they exist as a complementary team.

Managing organic waste teaches us this to a certain extent. What nature re-composes naturally, humans do by way of composting. If plants have to grow, the soil's living "attributes" or "fertility" must be maintained intact. In growing food, the output or yield is directly dependent on the fertility of the soil. Replenishing the nutrients can be done with compost whose creation is a collaborative task undertaken by the micro fauna and flora in the soil under favourable physical conditions. When organic waste is given to the soil microbes, they immediately begin to act upon it. Since they are of all kinds, they work on the organic waste at various levels step by step. This happens over a period of time at various levels till such a time that all possible forms of waste are broken down to the level of becoming a nutrient for plant growth. This "soil organic matter" is referred to as *humus*. The livingness of the soil is due to the humus in the soil. Humus is light and porous, moist, alive and teaming with active microbes. It maintains the porosity of the soil and forms the nutrient storehouse for the growth of robust, healthy plants. Composting is the man-made method of replicating what nature does naturally.

Cooking, the most basic of human skills

Cooking is one of the most ancient of human activities. Providing nourishment for the family and the larger community has cultural, traditional, social, spiritual and religious significance. What we eat is what we are. It is a life skill activity that is shared by all humans universally.

In the family, it has been the prerogative of the woman of the house to be in charge of cooking and providing nourishing food for the family. On the other hand, quantity cooking or cooking for commercial purposes is seen mostly as a man's job. It is interesting to note that at the societal

level cooking has resulted in several gender related negative impacts for women.

Cooking and eating together are social activities that strengthen bonds. For children in the school, it is an opportunity to learn a variety of skills that can easily be connected to academic subjects. One can learn science, social science, mathematics, language, art through cooking. It is an activity that is an important part of routine family life and hence children will easily relate to similar activities in the home.

Cooking in the school kitchen offers a good opportunity for integrated learning. It can be further enhanced by linking it to local farmers who can participate now and then to share their food growing experiences with children. It can also be linked to the home by inviting parents and grandparents to share their traditional recipes. This brings out the wonderful linkage between people who grow food for us and the people who cook it for us. Both play a very significant role in nurturing our bodies. This service should be held in high esteem. It will be good for children to learn to do so from a very young age. One sure way of doing it is to make it a school activity. The value of this most basic of life skills is greatly underestimated. By cooking in school, children also learn to respect the food they eat and their respect for food providers builds up naturally. From a young age children learn to respect the effort that goes into growing and cooking food and learn to make good food choices for good health. Further, it builds respect for locally grown foods, contributing significantly to the local economy, thus having a positive impact on the local environment.

The actual act of preparing a meal can develop many skills in organising a nutritious menu, procuring good raw material from the market, skills in ingredient preparation, cooking, following proper instructions and sequential procedures. Kitchen clean-up is a first hand lesson in orderliness, cleanliness and hygiene.

Cooking brings the participants together, increases bondage between family members, builds self esteem and self confidence in children, and provides an exposure to the richness of cultural and traditional diversity in human communities. Academic topics find linkages at several levels proving a direct relevance to life situations. Children see the linkages to origin of foods, cultural diversity, importance of balanced and wholesome diets for good health, and, the positive outcome of productive engagement.

Through participation in these processes one may hope that children will arrive at a simple thumb rule of fundamental non-negotiables of ethics, efficiency and economy (care, thrift) for living as non-violent, cooperative, contributing members within the larger *community of beings*.

4. Resources and References

Placed at the disposal of the teacher, student or anyone else who would like to use this book are a hundred and thirty resources (see the accompanying CD *'Tending a Schoolyard Garden: Resources'*). They consist of curricular ideas, lesson plans, teacher notes, workbooks, books, booklets, documentaries, articles, practical DIY (do-it-yourself) manuals etc. For ease of access they have been placed under 21 broad categories, listed in alphabetical order. The serial number carries a suffix 'e' for essential reading and 'f' for further reading. These resources are far from exhaustive but are good enough to begin with. School libraries have books that can supplement this content. Some resources in Hindi have also been included.

A good website to look for books on education is http://www.arvindguptatoys.com/

Youtube on the other hand (https://www.youtube.com) offers scores of small video clippings of any technique/experiment of interest. For gardening experiences of newly initiated gardeners one can visit http://www.thealternative.in/tag/my-edible-garden

Resources

List of resources contained in the CD accompanying this book

Sl. No.	File/folder title in the CD	Description
1-e	Our Land Our Life	A book of curricular ideas and syllabus for school age children (and youth) for skill and knowledge based learning. This is the precursor to the present handbook. Essential. The section also contains a brief overview presentation on the curriculum.
2-e	OLOL Teacher notes from field tests	This folder contains files with notes from the teacher's diaries maintained during the period of field testing the rural curriculum – class 1 to 7 and also a file listing the experiments conducted in the class/field. Useful for anyone who would like to use the curriculum.
3-e	OLOL_Our Land Our Life_ Engish workbooks_pdf_cl vi,vii,viii,ix,x	These are a set of excellent workbooks developed by Uttarakhand Seva Nidhi based on testing units in the field. The books are a part of the course work of government run schools in the state of Uttaranchal. Essential. Offered in workbook format, ready for use by teachers.

4-e	**OLOL_Hindi workbooks_ Hamari Dharthi Hamara Jeevan_pdf_cl vi,vii,viii**	**The same as above in Hindi.**
5	**Gardening**	**This folder contains notes, presentations, books to help with the starting and keeping of a school garden.**
5a-e	Formulations for Organic Farming	Biodung composting as developed by Dr. Priti Joshi. The document contains methods of biodung composting, vermicomposting as well as formulations of broad spectrum growth promoters and pest repellants.
5b-e	Growing food on severely eroded land_Deepika_ pebble garden	Deepika Kundaji explains how severely eroded land can be brought to life for growing a garden. This is the story of a living experiment in Auroville, Puducherry.
5c-e	Legume Logic	B. N. Nandish, the master mulch man of India shares his insights on legumes as mulch.
5d-e	List of Spices	This list developed by the Spice Board of India lists indian spices with their botanical name, family and part of the plant used.
5e-e	Manual on Home Gardens	This manual has been developed by Dr. Ardhendu Chatterjee. Well illustrated, easy to follow. Extremely well written by a master teacher and trainer in permaculture techniques.
5f-f	Millets: Future of food and farming	This little booklet is full of coloured pictures of millets, the staple of rainfed farming areas in India. Both students and teachers will benefit from reading it.
5g-e	New Agriculture a Permaculture Point of View	This little booklet is a compilation of notes that Dr. Venkat kept. It was published after his death. An essential reading, contains the essence of his wisdom.
5h-e	Organic Farming Packages and Practices	This is a presentation of various practices by Dr. Priti Joshi presented in easy to follow steps.

5i-e	Organic Urban Gardening	Contains articles on permaculture methods, home remedies and good nutrition. Brief. Excellent.
5j-e	Planting Guide for Vegetable Garden Crops	This calendar developed for south India by National Seed Corporation is very useful for planning planting of common vegetables. Similar guides maybe available for other regions.
5k-e	Plants at Usha - Shailaja Farm	Lists plants of a well known organic gardeners farm, shows the crop diversity one can have on a few acres of farmland. Educative.
5l-e	Seed Catalogue of vegetables form Annadana_seed savers	This is an excellent booklet to show children the diversity of vegetables. It is an inspiring catalogue for a keen gardener to explore growing diverse vegetables. Pages 6-23 are filled with coloured pictures, a visual treat. A good introduction to seeds before moving on to Deepika's presentations below.
5m-e	Seed Production	This note on seed production is penned by the most well known and respected seed keeper in India, Deepika Kundaji of pebble garden, Auroville, Puducherry.
5n-e	Small scale production of home garden seeds_Deepika	This is the accompanying presentation for the above note.
5o-e	Some seed production and pest control techniques	This is a brief presentation showing some seed germination techniques employed in Kerala and an innovative rat trap by George Anthony an organic farmer from Kerala.
5p-f	Organic Retail: small is beautiful	'restore' is a small outlet selling organic food in Chennai, in this booklet they share their knowledge on running a small organic store.
5q-f	Sustainable Agricultural Practices	This book from Green Foundation brings together knowledge from practitioners in the field. Useful as a reference material for gardeners and farmers.
5r-f	Sustainable Agriculture: a manual by chetana Vikas	This manual is the result of decades of work by Chetana Vikas at Wardha. Useful.

5s-e	Telugu, English and Botanical names of some vegetables	Lists some common vegetables with details of the edible part of the plant and its nature of growth.
5t-f	Termites and Organic Farming	Dr. Pachegoankar shares his experience of termites as useful partners in farming. Informative, useful.
5u-f	Tree Species for Deccan	Lists the trees of the Deccan, useful for selection of trees for planting. Similar lists maybe available for other regions.
5v-e	Vegetable Diversity Presentation	This is an excellent presentation showing the diversity of vegetables, a visual treat for students and teachers.
5w-e	Vegetable Garden in School_subba raju and Dr Parimi team_nai alim_ sadra 2013	This is an excellent presentation developed by Subba Raju and his team on how gardening can be used to integrate all academic topics in school. Exemplar teacher orientation material.
5x-e	Vegetable Planting Calendar for Malnad by Vanastree	This list has been developed by Vanastree a group of women home gardeners in Sirsi, Karnataka. Useful in planning planting as also in developing ones own region specific list.
5y-f	Vegetable Science	A technical book written by scientists at Punjab Agriculture University. Parts of it useful as reference material.
5z-e	Vegetables & Spice List	Lists common vegetables and spices in Hindi, English along with its botanical name.
6	**Composting**	**Offers resources from the country's experts on the subject.**
6a-e	On Composting	This little booklet by Dr. Venkat is a good introduction to the topic.
6b-e	Role of Earthworms in Maintaining Soil Health	This small note by Dr. Sultan Ismail, the earthworm guru of India is a good introduction for the link between the earthworm and soil health. Can be read aloud to students.

6c-e	Sultan Ismail_ living soils presentation	Dr. Sultan Ismail in this presentation takes us through the life within soils with valuable information on how to enhance soil health with various formulations.
6d-e	The Earthworm Story	This little note introduces the world of the earthworm to children and notes on composting. Read aloud material and resource.
6e-e	Vermicompost a Film_Dr.Priti Joshi	Dr. Priti Joshi studied composting as part of her doctoral work. She developed the bio-dung compost method, This film by her introduces children to various composting techniques.
6f-e	Vermicompost Production Technology	This is a PPT on vermicompost technology by Dr. Priti Joshi.
7	**Food, Health and Wellbeing**	**Contains resources on medicinal plants, nature cure and a book of millet recipes.**
7a-f	A Complete Handbook of	In this book by H. K. Bakhru, says that the right food Nature Cures can work wonders and has tremendous curative powers.
7b-e	The Garden of Life	Is a book on the healing plants of India by Naveen Patnaik, well illustrated, very educative.
7c-f	Medicinal Plants	This is a technical book written from a botanist's perspective by S. K. Jain of the Botanical Survey of India.
7d-f	Millet Recipes	This little booklet attempts to reintroduce millets into our daily diet with many interesting recipes that students will be happy to experiment with.
8	**Pests and Weeds**	**Pests and weeds are a reality in the life of a garden. This section offers a good introduction to some insect pests and invasive plants.**
8a-e	Biological Pest Control	This small document introduces children to various pests and their control using biological formulations. These formulations have been tested by the author for their effectiveness.

8b-e	Herbal repellent application techniques_ Jafarali	Jafarali developed some techniques of using nature to take care of natural pests. This brief presentation explains how.
8c-e	Invasive Plants of India 1	This document has excellent pictures with brief description of some of the common invasive species that have now colonized the Indian countryside.
8d-e	Invasive Plants of India 2	Part two of the above.
9	**Human Waste - pee and poo**	**Human Waste recycling science for your reading pleasure.**
9a-e	Poo	Pee and Poo we all do. Sourab Phadke however is presenting some ideas on how best to deal with this much neglected natural resource. Excellent resource presented in cartoon form.
9b-e	Sewage	This is a presentation on sewage that teachers will find useful when dealing with several topics under food, nutrition, gardening, composting, community issues etc. It is teacher education material; can be used for high school level students.
9c-f	The Humanure Handbook	Joseph Jenkins is known the world over for this masterpiece. A large book that covers all one needs to know about recycling human waste. With 7 billion people on planet earth, it is time to take Jenkins seriously. A good teacher resource.
10	**Energy: Solar energy and fuel efficient cookstoves**	**Contains books on understanding solar energy and fuel efficient cookstoves. Thinking on these lines we feel is essential as it is the need of the hour.**
10a-f	A Technical Manual of Improved Cooking Stoves	Apart from cookstove designs this booklet published from Bangladesh contains some essential information on energy audit calculations that students of higher classes may find of interest.
10b-f	Done in Sun	Contains many activities that young children can undertake to familiarize with the topic of solar energy.

10c-f	Energy	This little booklet offers an introduction to the topic as well as activities related to various forms of energy used in our daily life.
10d-e	Story of Solar Energy	Arvind Gupta the master story teller of our time and the wonder man of hands-on-science activities for children has written this book in a cartoon form. A must for children (and adults) of all ages.
10e-e	Understanding Stoves	Sai Bhaskar N. Reddy has dedicated his life to developing fuel efficient stoves and propagating its use in India. This mammoth work needs recognition and emulation. Essential for anyone, especially so for introducing children to the issue of fuel efficient ways of cooking our food.
11	**For the Curious Nature Buff**	**These books are for the student who shows keen interest in nature study. However science in the backyard is an excellent teacher resource also.**
11a-e	Backyard Science	This book titled 'Science in the Backyard', written by Elizabeth K Cooper is essentially written for the child, who by nature is a curious adventurous creature. It contains useful information on learning from the observation of the outdoors. Written in an easy to follow style, the teacher can use it to enthuse children to learn from the outdoors. Although written for the West, can be easily adapted to suit children in India.
11b-e	Calendar of Nature - Phenology_seasonswatch	This book of Phenology published by Seasons Watch is most essential as the planet faces unpredictable weather, rise of global temperatures; children need to learn the effects of such phenomena on nature and its implications. Phenology should be a mandatory topic in school, more so, if one is growing a garden.
11c-f	Nature Watch	This book by Khushwant Singh tells you of trees, flowers, fruits, birds, snakes, insects and animals to be seen during the year in and around Delhi. It is an inspirational book for any lover of nature; to know that writers are keen observers of human behaviour and of nature.

11d-f	The wonderful world of insects, trees and wild flowers_ruskinbond	Ruskin Bond the writer of children's books, too was and is a keen observer of nature as well as a nature photographer. He used to take the children of his care-taker family for walks routinely to look at the wonderful flora and fauna that a hill town offers. All children should be introduced to this side of his personality and draw inspiration from it.
12	**Ecology and Environment**	**Contains books on ecology and critical environmental issues.**
12a-e	A primer of ecology	This is a small compilation taken from Edugreen, TERI by Late Shri Mohan Pai. Written in a simple and straight forward manner, it forms a good ready material for the teacher to introduce the topic. Senior students will be able to follow the book by themselves.
12b-f	Biological Rhythms	This article on biological rhythms by Mohan Pai is a good, ready resource for the teacher to introduce this little known subject which is almost magical as it unfolds in our lives every day, every moment.
12c-f	Carbon cycle	Offers a broader perspective to the most abundant element on the planet and its role in the predicament that we have brought upon ourselves.
12d-e	Diversity - the cornerstone of life	This book by the most respected ecologist of India Dr. Madhav Gadgil would be extremely useful for the teacher as a self educative material which will come in very handy when dealing with this topic in the school.
12e-f	Ecology	A good introductory primer on the topic.
12f-f	Global Warming	This is an introduction to global warming in the Indian context. Written in very simple language by Nagraj Adve, it covers the topic very accurately. Adve has made a deep study on the subject from an Indian perspective and writes regularly on the topic in newspapers and magazines.
12g-f	Living Resources	A good primer for understanding the topic .
12h-e	Peak Oil PPT	This is a powerful presentation that introduces this complex topic in a very simple way.

12i-f	Peak Oil Primer	Introduces us to the concept of Peak Oil and its consequences. T. Vijayendra is one of the first in the country to have started articulating about this critical issue. The debate has yet to gain public attention. We are in a state of denial. It is essential that teachers open this dialogue in schools.
12j-e	Pollution	A good introductory book on the topic.
12k-f	Predators and prey	Dr. Ulhas Karanth, a wildlife expert writes about the high drama that unfolds in nature everyday. A good read aloud book that the teacher can use in the class to introduce children to the food chains in nature.
12l-f	Understanding Carbon Footprint	Deepika Prasad, a young engineering graduate wrote this book when the topic was just gaining attention. A good resource, written in simple language.
12m-f	Web of life	A good introductory primer on the topic.
13	**World of Plants and Animals**	**Brings to life the wonderful world of plants and animals that one will find relevant to the schoolyard garden.**
13a-e	100 Beautiful trees of India	Written almost a century ago this is a beautifully illustrated book by Charles McCann who was joint-curator of the Bombay Natural History Society.
13b-e	Bow out, butterfly	Brings the world of the moth centre stage. Full of coloured photograph, just wonderful, and, so rare.
13c-e	Common Birds of India	Edward Hamilton Aitkin has done a wonderful job of grouping birds into easily discernable categories. He lived in India a long time ago and has penned many wonderful books. Contains valuable tips to begin identifying birds that visit the schoolyard garden.
13d-f	My Book of Trees	Very well written and illustrated for easy understanding.
13e-e	Odonates and Dragonflies	This little booklet will hold children's fascination with its wonderful coloured pictures of those little helicopters which zoom around gardens.

13f-f	Satpada	A masterpiece introduction to the world of insects.
13g-f	Snakes	It is essential for all children and adults who work outdoors to know the scientific facts about these most misunderstood of God's creatures.
13h-e	Ten Little Housemates	A delightful little book that introduces us to the little creatures that we share our homes with.
13i-e	Class Insecta_Atul Sharma	This is an easy to follow presentation on the dominance of class insect. Ideal for introducing children to the world of insects.
14	**Land and Water**	**Contains Science experiments, books on water harvesting and the Rajasthan story.**
14a-f	Radiant Drops of Rajasthan	Anupam Mishra has written this wonderful book on how the water deficient region of our country had developed techniques of self sufficiency in water. Essential reading for our times.
14b-f	Land and Water	A good resource.
14c-e	Some Reflections on Watershed Development	This book by Dr. Venkat is essential reading for understanding the soil-water-human connect.
14d-f	UNESCO experiments in environment science-water	This is a UNESCO publication for schools. It offers several experiments on the topic of water.
14e-f	Water Harvesting Manual	This book is a good introductory reader.
14f-f	Water Resources of India	A well written book for advanced reading on the topic.
15	**Construction**	**A collection of resources on understanding mud as a building material as well as some real construction work done by schools using earth and natural materials .**
15a-e	Earthbags	Aman Sethu School has been experimenting with earth and natural materials for constructing classrooms. Sourabh Phadke has written this booklet so that others can benefit from their experience.

15b-f	Houses and Cities	A well written book on the subject.
15c-e	Mud	Laurie Baker returned to India to spend the rest of his life here, creating a revolution in how we view our traditional ways of construction. Essential Primer.
15d-f	Roofs 1	Has drawings and instructions on various kinds of roofs one can build.
15e-f	Roofs 2	Part 2 of the above.
15f-e	The Cob Class	Sourabh Phadke's photo documentation of a class-room construction with cob at Aman Sethu.
15g-e	The Rocket and the Rabbit Hole	Sourabh Phadke's photo documentation of a class-room construction with Earthbags at Aman Sethu.
16	**Toxins and Hazards**	**A collection of essential readings on the topic.**
16a-e	Danger Within	A book on occupational hazards.
16b-f	Our Toxic World	This is a comic strip book that deals in much detail about all the toxins we are exposed to in our daily living.
16c-f	Pesticides are Poison	Jeff Conant is an active educator on the effects of pesticide use. A must read for anyone who is growing food.
16d-e	You, Me and Disaster	Is a book introducing children to the topic of disasters – both natural and man-made. Essential.
17	**The way of community**	**Books related to social geography and community. If the school has to integrate into the community it will have to begin engaging with community members sooner than later. Children need to learn democratic ways of engagement and a good place to begin is in the school.**
17a-f	Life in a Factory	A good teacher resource to engage with children on the topic of unethical working conditions. (Mostly non-indian context).

17b-f	People Action	A good resource to introduce children to the exploitative nature of people in power and how solutions are sought. Teacher resource.
17c-f	Promoting Community Environmental Health	A good resource of ideas for extending work into the community.
17d-e	Towards Responsible Citizenship	This is an article written by Sushama Sharma, the principal and head teacher at Anand Niketan. She writes about a situation in school that demanded detailed discussion with students and staff for a democratic and cooperative resolution of a issue that arose in school.
17e-e	Woman ecological farmer from Medak Dist Andhra Pradesh_ Laxmamma	This is the story of a women farmer community in Medak District who have today become self sufficient ecological farmers and community leaders_ Laxmamma's story.
17f-e	Woman ecological farmer from Medak Dist Andhra Pradesh_ Samamma	Same as above – Samamma's story.
18	**Academic Linkages**	**Contains material on drawing academic linkages through games, projects and study to garden work.**
18a-e	Balanced Diet_Sushama Sharma_Anand Niketan	This is an exemplar module developed to introduce cooking in class through the preparation of khichadi. It shows how food can be linked to various academic topics as well as social and cultural issues.
18b-e	Biodiversity	This excellent presentation was prepared by Dr. Ardhendu Chatterjee and his team at the Nai Talim workshop at Sadra in November 2013.
18c-e	Concept maps to introduce gardening	This provides three examples on how gardening can be introduced to children and on how to draw academic linkages.
18d-f	Factors of Soil Formation	Is a brief and useful presentation for teacher education.

18e-e	Geography is Fun	This is the story of a little boy who makes sense of why geography is important and learning it can be fun.
18f-e	Green Games	This book by Centre for Environment Education offers many games through which children can be introduced to topics in environmental science.
18g-e	How You Began	This book explains very simply human embryonic development. J.B.S.Huldane in the foreword to the book regrets that it was not written when he was a young boy and what a lacuna in his life this left. Essential.
18h-f	Low cost equipment for science and technology education 1	This book from UNESCO offers many ideas for schools with limited resources.
18i-f	Low cost equipment for science and technology education 2	Part 2 of the above.
18j-e	New UNESCO Source Book for Science Teaching	This is an age old classic by UNESCO on basic experiments in science. The biology section is especially very well presented.
18k-f	One Earth	A good resource.
18l-f	Soap Bubbles	This is an educational classic of all times.
18m-f	Soil-Introduction	A brief presentation for teacher education, useful.
18n-e	Teacher orientation notes on some contemporary ecological concerns_ nyla coelho	This is an essay (for the teacher) that is in the form of a ready reference directory of how we need to look at certain issues from an ecological perspective while engaging with children.
18o-f	The Historian's Toybox	A beautiful book on the toys of yore and how to make them.
18p-f	The Weather Riddle	A book for advanced reading on all matters pertaining to understanding weather.

18q-e	Water linkages to academics_ pande and team_sadra 2013	This is a brief note in Hindi on drawing academic linkages to the study of water and land. Prepared at Sadra by Dr. G.P. Pande and his team at the Nai Talim workshop in Nov 2013.
19	**Back to the Source**	**Introspective readings for teacher orientation**
19a-e	Working our way home	This brochure contains select excerpts from Wendell Berry's writings. Wendell Berry is an American scholar who gave up academia to pursue farming. He has been an inspiration to an entire generation of people who are trying to live their life on ecological principles .
19b-e	New Story for New Economy	An article about what the future can and should be if we are to survive as a species.
19c-e	One Straw Revolution	The Japanese scientist, Masanobu Fukuoka who went back to natural farming pens his classic. It has inspired the present organic farming community worldwide.
19d-e	Points to Ponder	This is an essay by Nyla Coelho addressed to the teacher on what must be our ecological orientation while engaging with children today.
20 e	**Gardening Curriculum Notes**	**These are curriculum notes in English and Hindi on drawing subject linkages to gardening activity - class 1to 7.**
21 e	**Creative Lesson Plans for Teachers, Educators and Community Workers**	**This is a treasure trove of A-Class integrated lesson plans prepared as part of a series under the Ecology and Natural Resource Education project of DRCSC, Kolkata. They have been conceptualised by Ardhendu S. Chatterjee and developed by Satoko Chatterjee the author of 'The Green Sprout Journey'. This resource has been kindly shared by Sujit Sinha of Azim Premji University. Teachers can begin with books on Vegetables, Insects and Worms, Trees, Medicinal Plants, Water, Birds and then move on to the others. Each one is highly recommended.**

References

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Teacher Notes

Teacher Notes

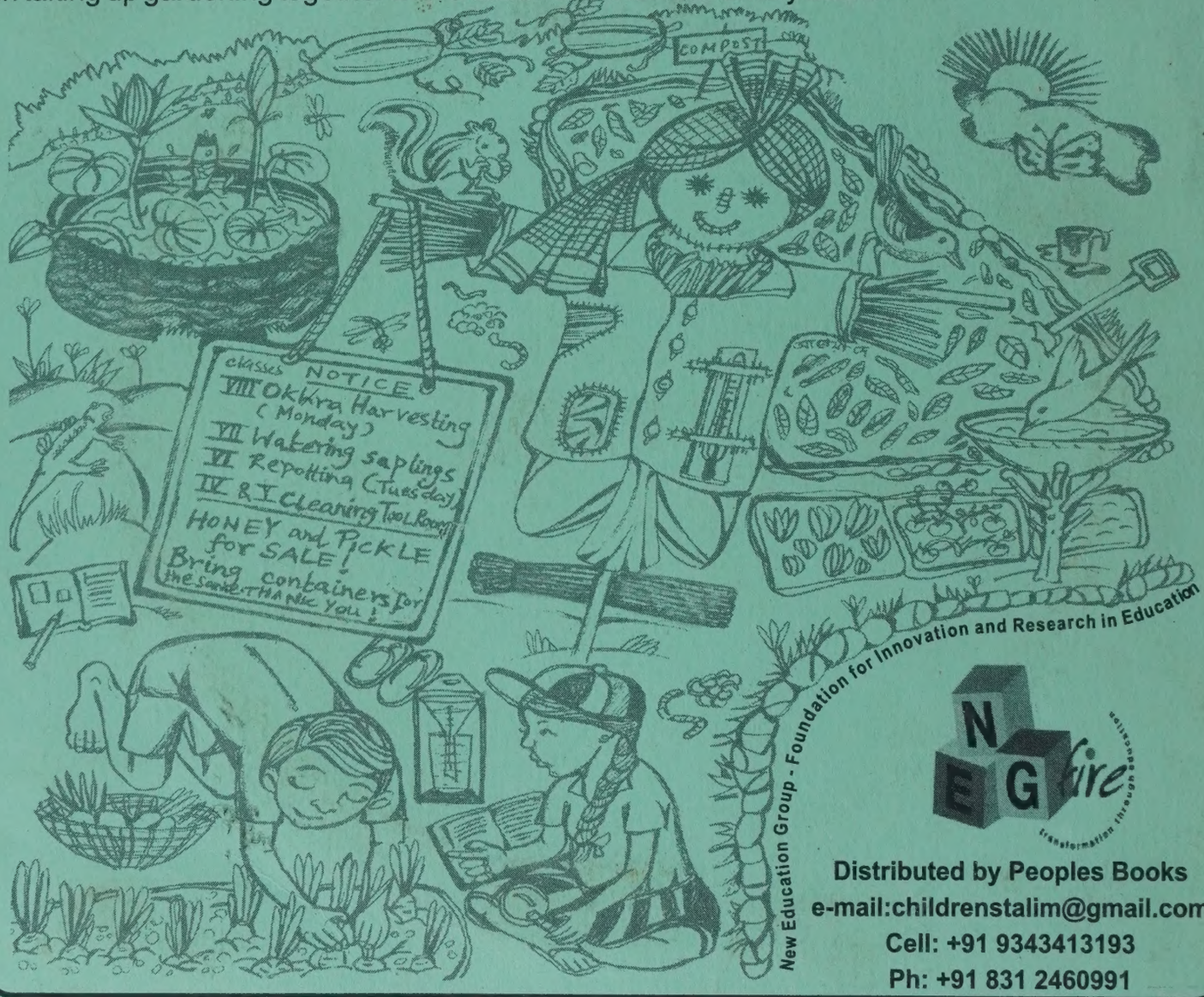
Teacher Notes

Tending a Schoolyard Garden

This teacher handbook attempts to plant the idea of tending an edible garden in the minds of educators. The cyclical nature of all natural phenomena become self evident through gardening. Equipping children to align with this understanding is considered the most essential educational need for present times – going beyond theory, linking learning to practice, extending the classroom space to the outdoors. Through gardening, children gain skills and become creators of their own knowledge – tried, tested, self validated. Linked to cooking and composting, it draws children's attention to critical issues of food and nutrition, health and sanitation, energy and water.

Written in an easy to follow style with step by step instructions, the book offers teachers the necessary wherewithal and the confidence that this is doable. Included are essays for teacher orientation and notes on pedagogy for creating linkages to academic subjects. The accompanying CD comes packed with a hundred and thirty carefully selected resources placed under twenty one categories.

This handbook is based on field tests at Anand Niketan, Sewagram and similar pioneering endeavours elsewhere. Although written as a school programme, anyone interested in taking up gardening together with children will find it extremely useful.



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